ARCHIVES OF OTOLOGY.

ON THE FUNCTION OF THE CHORDA TYMPANI.

By OSCAR WOLF, of Frankfort-on-the-Main.

Translated by C. de Lanza.

INASMUCH as the question concerning the physiological significance of the chorda tympani is not yet finally settled, I may, perhaps, be permitted to add a short contribution, derived from clinical observation, to the literature on the subject. In doing this, I comply with a request made by Prof. von Vintschgau in his excellent treatise which has recently appeared. He says:

"The second way of examining the question of the nerves of taste is that of clinical observation. It cannot be denied that such observations are highly important, and in many cases superior to experiments made upon animals." Further on he says: "Exact clinical observations not only serve to verify experiments performed upon animals, but also to indicate to the physiologist the direction in which new experiments are needful."

Upon examination of the careful literary studies in this work, I find that in reference to the chorda tympani, the following questions still remain more or less open to discussion.

1. Does the chorda tympani in its tympanic portion contain sensitive and so-called salivary fibres besides gustatory fibres? *

2. Which portions of the surface of the tongue are supplied by the chorda?

* Physiologie des Geschmacksinnes, von Prof. M. von Vintschgau. *Handbuch der Physiologie*, edited by Prof. Hermann, vol. iii, Leipsig, 1880.

3. Which nerve-tracts establish the connection between the peripheral portion of the chorda and the central organ?

A recent communication from Blau * in regard to this subject, which I have already reviewed in the report on the Progress of Otology,† confirms the idea that irritation of the chorda in the tympanic cavity not only produces sensations of taste, but likewise a feeling of prickling and stinging upon the tongue.

The increase of the salivary secretion upon irritation of the chorda, which has been observed by numerous authors (Bernard, Eckhardt, Schlüter, and Heidenhain), and which has also been confirmed by myself, can, in my opinion, be interpreted as a reflex phenomenon.‡ The decision on this point must, however, be reserved for physiological investigations.

In regard to the second question, the following observation may be useful, inasmuch as it points out the way by which the expected goal may be attained.

Mr. C. H., a merchant, 50 years of age, consulted me in February, 1874, in regard to a difficulty of hearing which he experienced in his left ear, at the same time complaining of occasional annoying entotic sounds. He had formerly suffered considerably from catarrh of the Eustachian tubes, and recently, his sense of hearing had perceptibly diminished: whispering voice, 1′; loud voice, 10′; watch on contact. Upon examination, the left drumhead appeared opaque and greatly depressed, so that the posterior fold protruded markedly. By inflation the hearing improved considerably, but only for a short time, for with the collapse of the drumheads the former condition returned. As, at that time, much praise was bestowed upon the results of incision of the posterior folds recommended by Lucae and Politzer, and inasmuch as I had personally been very successful in this operation, I accordingly performed it upon C. H. on April 2, 1874, cutting the

* Ein Beitrag zur Lehre von der Function der Chorda Tympani, von Dr. Louis Blau, Berlin, 1879.

† These ARCHIVES, vol. ix, p. 171.

‡ Eckhardt and Heidenhain are of the opinion that the chorda contains the secretory fibres destined for the submaxillary gland. These fibres according to the above-mentioned investigators emanate from the facial nerve. (See Eckhardt, in *Henle and Meissner's Jahresbericht*, 1862, p. 418. Also Heidenhain, Beitrage zur Lehre von der Speichelabsonderung. Studien des Physiol. Institutes in Breslau, vol. iv, p. 23, Leipsig, 1868.)

Mt from top to bottom with a lance-shaped needle. The drum-head resumed its normal position immediately after the operation, and the range of hearing rose to 4″ with the watch, 22″ whispering, *but the chorda was likewise cut through.* Immediately after the operation, the patient informed me, without being questioned in any way, that he experienced a peculiar sensation, or rather a total absence of sensation upon the left side of the tongue. The latter felt cold and smooth, as though he passed it over a piece of cold metal. The next day, he declared that everything he ate was apparently *without salt,* and that whatever came in contact with this particular side of his tongue tasted like marble.

I now examined his faculty of taste in various ways, principally by means of sugar, diluted acetic acid, cooking salt, and quinine, in order to determine the extent of the affected part. The complete loss of taste began exactly in the middle line of the tongue but did not extend more than 2 centimetres back. The paralysed part, therefore, formed a right-angled triangle, whose hypothenuse was formed by the edge of the tongue, and whose longest side (the middle line of the tongue) was 2 centimetres in length. Substances of the most pronounced taste produced no effect whatever within this triangle, and sensibility in regard to tactile and thermal excitation was likewise withheld. Warm solutions felt cold, and rough matter appeared to the patient as smooth as polished marble.

Experiments to ascertain the perceptions of taste, were conducted with the precautions recommended by physiologists.

To determine the precise extent of the paralysed part, rapidly dissolving pulverized substances, as chloride of sodium, sugar, and quinine are the best. Some confusing experiments were made with grains of sand; table-salt, placed upon the healthy portion of the outstretched tongue, was recognized in a few seconds. The sensations of taste were intensified when Mr. C. H. pressed with his forefinger the salt firmly upon his tongue. The same experiment, made upon the paralysed side, produced no sensation either of taste or of touch. When fine sand was strewed upon the healthy side, and salt simultaneously upon the paralysed part, there was no perception of taste whatever. The reaction of salt upon the unaffected side was more rapid and

pronounced when the patient was directed to press his tongue against the palate; on the other hand, however, salt could not be distinguished from sand, when the paralysed side, alternately strewed with salt and sand, was pressed against the palate.

Sugar, when placed upon the healthy part of the protruded tongue, could not be recognized as such; it therefore showed a much weaker action than salt, and tasted sweet only when the patient pressed his tongue against his palate. The paralysed side could not recognize sugar and quinine, even when the tongue was in contact with the palate. The latter experiment is especially referred to, inasmuch as the intense bitterness of the quinine was only apparent upon the healthy side of the tongue when the patient pressed his tongue against the palate.

In order fully to comprehend this, we must recapitulate the statements of physiologists concerning the faculty of taste exhibited by the tip of the tongue. Wagner, Funke, and Valentin completely deny that it possesses any. Tuzani and Lussanna affirm that they cannot perceive any bitter taste with the tip of the tongue, but at the same time they observe that this absence of sensibility is not constant and alike in all persons. Von Vintschgau finds the perceptivity of the tip of the tongue for bitter substances very slight; while, on the contrary, Vernières, Guyot, Admyrault, Klaatsch, Stich, Budge, Neumann and others attribute to it some, and Urbantschitsch, even an excellent faculty of taste. According to my own observation, this difference of opinion can be explained partly by the individuality of the persons experimented upon, and partly by the method of conducting the experiments. At all events, it is undeniable that certain substances, especially salt, can be distinguished even when that portion of the tongue upon which it is put is not pressed against the palate. To discriminate fine differences of taste, the coöperation of the nerves of taste in the palate (n. glossopharyng.) with those contained in the tip of the tongue (chorda tympani) seems requisite. To explain this physiologically, is reserved for future investigation. As an analogy we may point out the

double function of the acoustic nerve* (cochlear nerves for the perception of tones, vestibular nerves for noises), so that the different nerve fibres of taste would be, as it were, differently tuned for different substances.

At any rate, it is an established fact that a sensation of taste is produced, or an indistinct sensation rendered intense, by the mere pressure with the fingers upon the tongue upon which the substance to be tasted has been laid. This can be explained mechanically in such a way that the pressure of the finger forces the fluid more quickly and effectively into the small fissures into which the gustatory goblets empty solid and liquid food just as the tongue presses against the palate.

If we retnrn to the analysis of the case under consideration, we must expressly assert, notwithstanding the theory offered by Blau (according to which the tip of the tongue is not supplied with chorda-fibres), *that the paralysis of taste and sensibility in our case comprised the entire triangle pointed out above, and consequently the tip of the tongue also.*

The course of the case is exceedingly interesting on account of the restoration of the functions of the chorda, which occurred when the divided nerve was reunited and its conduction reëstablished. The paralysed triangle began gradually to grow smaller from behind forward. On the fourth day after the operation the demarcation line of taste had advanced about one-half centimetre.

April 10th.—The range of hearing was almost uniformly 24″ for whispering, 4″ with the watch. The straight position of the *Mt* was permanent. The wound caused by the operation had entirely healed; on the left side of the tongue everything tasted an insipid sweet; salt and sugar could not be distinguished from each other.

April 12th.—Salt was recognized when dissolved upon the tongue, sugar, however, only tasted sweet when the tongue was pressed against the palate, and quinine had a bitter flavor under the same circumstances.

April 15th.—No further alteration of taste.

* These ARCHIVES, vol. viii, p. 393, reprint of Preyer's *Grenzen der Tonwahrnehmung.*

The restoration of the powers of taste and sensibility was rather slow, for it was not before May 30th—that is, eight weeks after the operation—that both sides of the tongue showed the same reaction.

All my patients, including the one designated as Case 2, L. B. (ARCHIVES OPHTHALMOLOGY AND OTOLOGY, vii, p. 90), in whom the chorda lay bare in the upper posterior quadrant, so that it could easily be irritated with a probe through the ear-canal, universally declared that the pricking or stinging sensation extended to the tip of the tongue, and the metallic taste, which the contact of the probe excited was perceptible only on the side of the anterior triangle of the tongue.

My colleague, Dr. Carl, in whom the gustatory fibres are paralyzed, but the sensitive fibres of normal reaction,* assured me a short time ago that the paralysis included the tip of the tongue, and also the pricking sensation caused by probing irradiated as far as the tip of the tongue. Consequently, we may consider it an established fact that the tip of the tongue is plentifully supplied by means of the chorda with sensitive as well as gustatory fibres, in adults about 2 *cm.* in extent; so that the so-called acute taste, if not solely dependent upon the function of this nerve, at least would require its coöperation. To ascertain by which way and with the assistance of which ganglionic connections the sensations of taste are conveyed to the central organ, must be reserved for future investigation.

That the subject, however, may be as comprehensive as possible, I will now consider the investigations which have recently been made in regard to the third question.

Schiff† lets the nerve fibres, which are assigned to the different parts of the tongue, leave the medulla oblongata with the roots of the trigeminus nerve, and go with the second branch out of the cavity of the cranium to the spheno-palatine ganglion, whence they either proceed directly through the sphenoidal nerve to the third branch of

* See contribution concerning the question: "Does the chorda tympani contain fibres of taste?" by Dr. August Carl, Frankfort.

† Schiff. Leçons sur la physiologie de la digestion, I. Florence and Turin, 1867, p. 140

the trigeminus, or else through the Vidian nerve to the geniculate ganglion of the facial; then either unite in the ganglion with the inferior maxillary nerve, or are connected with the lingual branch through the chorda tympani. According to Lusanna,* who agrees with Duchenne in thinking that the chorda is a continuation of the intermediate (Wrisberg's) portion of the facial, the fibres of taste pass with the intermediate portion of Wrisberg to the geniculate ganglion, and thence with the chorda tympani to the lingual branch of the trigeminus.

Dr. Carl, whose ear I have repeatedly examined, states, in reference to the above-mentioned observations made by himself, that the fibres of taste supplying the anterior part of the tongue take their origin in the glosso-pharyngeal nerve, proceed through the petrosal ganglion and the tympanic nerve to the tympanic plexus, and from there partly through the superficial petrosal nerve to the otic ganglion and the lingual, and partly through the communicating branch of the tympanic plexus to the geniculate ganglion, and thence through the facial and chorda to the lingual branch.

Von Vintschgau, after having quoted all these opinions, comes to the following conclusion:

"Although we cannot deny that much pain has been taken to discover the *origin* of the fibres of taste in the two anterior thirds of the tongue, we must confess that the problem has not yet been satisfactorily solved."

Concurring with this opinion, I would only make the restriction that the chorda tympani does not supply two-thirds, but only one—the anterior—third of the tongue.

* Lusanna. Destruction du goût à la partie antérieure de la langue par suite de la section de la corde du tympan. *Gaz. Méd.*, Paris, 1864, 3d year, sec. xix, p. 409.

A PECULIAR MODIFICATION OF THE OSSEOUS TISSUE IN THE PYRAMID OF THE TEMPORAL BONE.

By S. MOOS and H. STEINBRÜGGE, of Heidelberg.

Translated by J. Bettman, M.D.

During the examination of the left temporal bone of a paralytic, whose labyrinthine disease is described p. 105 *et seq.* of this volume, Dr. Moos detected on the lateral side of the internal auditory meatus, a portion of bone which, notwithstanding the tissue had been softened in nitro-chromic acid, offered an invincible resistance to the knife. Besides this glass-like density, the yellow coloration of the part markedly contrasted with the greenish chromic acid staining of the remaining tissue. The notes taken then, were as follows: "Below and externally to the internal auditory meatus a yellow osseous nucleus was detected, measuring 1 *cm.* in length, 4½ *mm.* at its central width, 7 *mm.* at its widest part, and 2 *mm.* at its narrowest. Its narrow portion borders upon the ampulla of the posterior semicircular canal. On exposing it further, the new-formation assumes the shape of a pyramidal mass, the apex of which is situated almost at right angles to the trunk of the nerve in the porus acusticus internus."

Soon after, in both temporal bones of a girl, æt. 19, who had died of pneumonia, Steinbrügge found osseous changes which, as regards density and color, fully coincided with the above-mentioned case. The bones had been subjected to the same method of softening. A wedge-shaped mass,

about 6 *mm.* long and about the same size at its base, was situated on the right side between the lateral wall of the internal auditory meatus and the medial vestibular wall. It extended beyond the vestibule, composing part of its floor, and after encompassing the ampullar orifice of the horizontal semicircular canal, ended in the cancellous osseous tissue between the semicircular canals. This changed bony tissue occupied an almost symmetrical position on the left side, with the only exception that it also extended along the vault of the vestibule, at the same time projecting more inferiorly so as to completely surround the ampullar orifice of the frontal semicircular canal.

In the three above-mentioned cases, the channels or cavities surrounded by the altered bony substance were apparently not encroached upon. No swelling of the bone had taken place and the periosteum covered the exposed parts of the new growth in a manner similar to normal bone. On cross sections, the line of demarcation of the triangular mass, apart from its prolongations, attracted particular attention.

Examined microscopically, it presented, on the whole, the structure of compact bone tissue, but on counting, the bone corpuscles were found more crowded together than in normal bone; their offsets were very conspicuous, and the Haversian canals appeared narrower. The lamellar arrangement of the bone was not distinct and could only be demonstrated with higher magnifying power. Here and there, dust-like accumulations of molecular lime, as seen in ossifying cartilage, were noticeable.

Regarding the solubility of this tissue, various experiments with undiluted and strong nitric acid proved that with the exception of a small, soft, undoubtedly organic residue, it was perfectly soluble. The reason of its insolubility in chromo-nitric acid must be attributed to the dilution of the decalcifying fluid (2 per cent. nitric acid).

To assure ourselves, however, that no extraneous elements other than are found in normal bone, were present, we applied to Dr. Bernthsen, lecturer on chemistry, who kindly made a qualitative analysis. The result demon-

strated the presence of carbonate of lime, phosphate of magnesia, and a trace of fluor-calcium, on the whole, the normal constituents of bone. Dr. Bernthsen favored the idea, that this sclerosis might be attributable to the greater physical density of the substance, and that this may also have retarded the penetration of the decalcifying fluid.

We also could not but share this opinion, although a certain conclusion could only be arrived at by a quantitative analysis. Nutritive changes of the bone, inflammatory action or sclerosing ostitis, could be unhesitatingly excluded as causes, for the petrous portion of the bone, especially that portion under consideration, is composed entirely of dense compact bone. For the same reason, the idea of an enostosis is likewise inadmissible, for, according to Virchow, enostosis originates in the medullary substance. Besides, it is frequently accompanied by swelling of the bone, and its seat of predilection is the frontal and ethmoidal regions.

In reference to the inquiry, what factor was potent in producing this increased density of the bony mass, regards must be paid to the following points of consideration: (1) the relation of the mineral to the organic substances could be altered to the detriment of the latter; (2) a single mineral constituent, *e. g.*, the carbonate of lime, could have been inordinately deposited; and (3), what has already been accentuated above, it could have been due solely to an altered molecular arrangement, thus causing a physical modification of its relative density.

The microscopical examination seemed to favor the first point, *i. e.*, an increased deposition of the salts of lime. Yet it must be considered that in the few cases of eburneated bony tissue which have been chemically examined, no increase, but rather a relative decrease of the mineral constituents has been found. Lehmann* mentions that some investigations of Ragsky, referring to cases of osteosclerosis, osteo phytes, and exostoses, have led to the same result. Neither is the second point of consideration explained by the chemical analyses which are on record. While the relation of the carbonate to the phosphate of lime in cancellous bone tis-

* Lehrb. d. physiol. Chemie., Bd. iii, page 23.

sue is as 1:4, in compact bone as 1:5–7, in the dentine and enamel the phosphates are increased over the carbonates in the proportion of 1:11–12. Accordingly, the increased density of a substance is dependent upon the augmentation of the phosphates of lime. Ragsky, in his investigations, demonstrates, however, the disproportional increase of carbonates in pathologically sclerosed bone. Kühne* contrarily admits no change between the relation of carbonates and phosphates, and only in callus and osteophytes did he notice a relative increase of the carbonates of lime These few points illustrate the difficulty of determining the cause of sclerosis of bone, and will invite further attention to chemical investigations.

That this osseous change had been detected, in all three cases, in identical portions of the petrous bone, is remarkable, and naturally gives rise to the supposition that these scleroses may be more frequent, and in some way or other dependent upon embryonic processes of ossification. It is well imaginable that such indurations could have escaped the attention of former investigators. Stronger solutions of nitric or hydrochloric acid (5–10 per cent.) were formerly used as decalcifying fluids, and the sclerosed part could have been macerated as readily as the other, and thus escaped detection. The decided change of color, while treated with chromic acid, mainly attracted our attention. According to the investigations of A. J. Vrolik†, in human embryos of only 21 *cm.* in length, a point of ossification can be demonstrated in the bridge between the meatus auditorius internus and the hiatus canalis Fallopiae, which is near enough the spot occupying our attention. In the sixth month, however, this nucleus is incorporated with three others in the area of the labyrinth, and it would not be justifiable to regard the site of these so-called bone nuclei as being predisposed to later sclerosis. At all events, increased attention should henceforth be paid to the osseous structure in the lateral and upper walls of the meatus auditorius internus.

* Lehrb. d. physiol. Chemic., 1868, page 399.

† Kölliker, Entwickelungsgeschichte, 2 Aufl., pag. 739.

In conclusion, it may well be considered whether or not these changes can have any practical significance. Judging from the modest array of cases which up to date we are enabled to present, this question can only be answered with reserve. The larger channels and cavities, as we have seen, did not seem to be narrowed, but the more delicate passages, *e.g.*, the aqueducts, or the entrances of the vestibular nerves, might possibly be encroached upon. On account of the extreme density of the sclerosed bone the demonstration of such an alteration would naturally entail almost unconquerable difficulties. Besides its advantages in preserving delicate structural relations*, the method of decalcifying with a dilute nitric acid mixture will have the additional advantage of demonstrating alterations of density in the osseous tissue, a condition perhaps more frequent than can be supposed from the use of the former method.

* According to the recent investigations of Fr. Hesse (*Arch. für Anat. und Physiol.*, von His und Braune, *Anat. Abtheil*, 1879, 5 und 6 Heft), who dissolved the axis-cylinder of fresh nerves in a 0.1 per cent. solution of hydrochloric acid, the use of hydrocloric acid in histological examinations of the labyrinth, extolled by many, must be of very doubtful value.

ON THE USE OF THE DENTAPHONE WITH DEAF-MUTES.

By EDMUND TREIBEL,

SUPERINTENDENT OF THE ROYAL ASYLUM FOR THE DEAF AND DUMB IN BERLIN.

Translated by C. DE LANZA.

IN the ninth volume, part first of this periodical, we find a reprint from America concerning the effects produced by the dentaphone, and I felt some curiosity to convince myself of the actual worth of this much-praised instrument by personal investigation, for I had been assured by a prospectus from the American Dentaphone Company in Berlin, that "persons whose sense of hearing was defective, or indeed those who were *perfectly deaf*, could use this instrument with the utmost facility and with astounding results." After I had succeeded in obtaining one of these dentaphones, I resolved to make the most extensive and critical experiments with it of which I was capable, and above all things to acquire a perfectly clear and unprejudiced judgment concerning its availability. I first experimented upon persons who were entirely deaf, those who had been born so, and others who had lost their sense of hearing in early childhood. The result was utterly negative, inasmuch as not one out of the above-mentioned could hear any sound whatever with the aid of the dentaphone, even when the greatest effort was employed by the speaker.

I then selected, for further experiments, a large number of persons who still possessed some sense of vocal sounds, and on this occasion as before, I chose those who had been born deaf and others who had been afflicted later. The re-

sult was precisely the same as before, for it was with the utmost difficulty that I succeeded in making these people conscious of sounds which, even without the help of the dentaphone, they were capable of distinguishing if they were uttered loud and close to the ear.

I next proceeded with those who still possessed the capacity for recognizing words, and discovered that they could only understand very loud-spoken words by means of the dentaphone, but with no greater distinctness, and with no more facility than if the words had been spoken in the ear without the instrument at all.

I will simply add that in the course of these experiments, I made use of three different dentaphones, and always obtained precisely the same result.

I may safely state, therefore, that where deaf-mutes are concerned, the dentaphone, in its present condition at least, cannot be put to any practical use, not even as a means of advancing articulation. Also, judging from the experiments I have made upon perfectly healthy persons, I am inclined to doubt that the instrument can give any noteworthy assistance to any one whose hearing is in the least defective.

DEAF-MUTE STATISTICS OF THE PROVINCE OF POMERANIA AND THE DISTRICT OF ERFURT.

COLLECTED BY R. F. WILHELMI, M.D., SWINEMÜNDE.

COMMUNICATED BY DR. ARTHUR HARTMANN, BERLIN.

Translated by ISIDOR FURST, New York.

THE indefatigable efforts of Wilhelmi contribute materially to the knowledge of the hitherto somewhat neglected field of deaf-mute statistics. Any one who has ever undertaken a similar work will be able to estimate the amount of labor connected with the subject, and appreciate accordingly the merit of Wilhelmi, who gives us the foundations for deaf-mute statistics in Germany.

Through some purely external circumstances, the two extensive papers of Wilhelmi, although finished several years ago, have not been published. Mr. Wilhelmi most cordially assented to my proposal to publish an abstract of them in the ARCHIVES OF OTOLOGY, and I therefore take the liberty to present the sum and substance of the two articles, regretting that the limits of a periodical do not permit the printing of them *in extenso*.

I felt constrained, for the sake of conspicuity, to draw together the separate statistics of the Province of Pomerania and those of the District of Erfurt,

The statistics were gathered by means of proper blanks, with the aid of the government authorities, in connection with the general census taken in 1874–5.

From the Province of Pomerania, 1774 more or less correctly filed blanks were returned. Excluded were 41 persons who were either only deaf or only dumb, also 96 idiots, so that there remained only a total of 1637 deaf-mutes. With a population of 1,431,633, we have, therefore, to every 10,000 inhabitants 11.4 deaf-mutes. From the District of Erfurt the census returns were 325 deaf-mutes; of these had to be deducted 30 duplicates, 22 idiots, 1 deaf, 4 mutes, 1 since deceased, so that the statistics comprise 267 deaf-mutes. Entire number of inhabitants 369,-353; therefore, 7.2 deaf-mutes to every 10,000 inhabitants. The cause of the frequent occurrence of deaf-mutism in Pomerania will be considered further on.

From Table I,* a condensation of several of Wilhelmi's, may be deduced a confirmation of the earlier experience that males are more frequently affected with deaf-mutism than females; there being in the Province of Pomerania among 10,000 male inhabitants both in the cities (8.9) and in the country (14.1), a greater number of deaf-mutes than in the like number of female inhabitants (7.8 and 11.6). A similar fact is shown by the statistics of Erfurt.

Furthermore, both in Pomerania and in Erfurt, the largely more frequent occurrence of deaf-mutism in the country as opposed to the cities is conspicuous; there being in Pomerania among 10,000 city people only 8.3 deaf-mutes, and among the same number of country people 12.8; so in Erfurt, 5.4 and 8.5.

Table II shows the proportion of congenital to acquired deaf-mutism, and we find the surprising fact that in Pomerania the number of those with acquired deaf-mutism (1031) is nearly double that with congenital deaf-mutism (592); while the inverse proportion is found in the District of Erfurt 99: 168.

From the same table may be learned that the proportion for all deaf-mutes shown in Table I regarding the more frequent occurrence of the defect in the country and in the male sex holds good both for the congenital and the acquired deaf-mutism.

* Most of the tables are suppressed in the translation, but the results are given according to the author's statements.—K.

Table III shows the distribution according to age; there being in the Province of Pomerania a proportion differing from other statistics which becomes especially evident on comparison with that of Erfurt. It is the surprisingly great preponderance of the years 11 to 15; 494 among 1637 deaf-mutes belonging to this period. This greater proportion is owing to the epidemic of cerebro-spinal meningitis which raged in that province in the years 1864 and 1865, and made sad havoc among the children; this will receive more detailed discussion below.

The youngest deaf-mute child recorded in the Province of Pomerania is one not quite 2 years old; of the third year of age we find but 3; of the fourth, but 9 deaf-mutes. In the Erfurt statistics the series begins with the sixth year. Wilhelmi explains this fact with the statement that parents hesitate to believe in the presence of deaf-mutism in their children; "they hope, as they fondly desire, that the three- or four-year-old child will still learn to talk, the hearing will yet be established, until the painful fact must be taken as confirmed, irrevocable, and irremediable. To me, too, in the course of time, children of that age have been presented, the cause of whose lack of speech was said to be an adhesion of the tongue—tongue-tie—(an explanation very current among mothers and grandmothers). In these statistics, too, a deaf-mute is enumerated, of whom I distinctly recollect that he was presented to me when a boy of four years for such a defect of speech; but when I regretfully declared him to be deaf-mute, I encountered among his relations, not a grave doubt, but a positive disbelief. To some such very pardonable hesitation it should be ascribed that the number of deaf-mutes up to the fifth year of life is generally proportionately small in comparison with the succeeding ages." The oldest deaf-mute in the province had reached an age of 89 years.

A.—CONGENITAL DEAF-MUTISM.

1. MARRIAGES AMONG NEAR KINDRED.

Wilhelmi emphasizes that the material at our disposal is far too scanty to enable us to formulate a sufficiently justi-

fiable rule regarding the influence of near kindred among the parents upon the occurrence of deaf-mutism in the children. "On the one hand, the statistics which bear upon this point particularly, are still too few; and, on the other hand, congenital deaf-mutism is only one of the alleged causes. The entire subject, however, is so important that it is well worth the trouble of collecting records of all such marriages (and their number is not small) in a larger district, and to inquire into the bodily and mental conditions of their descendants in general. For the objection might not unjustly be raised that we have thus far no data at all as to the number of the marriages in question, and if the percentage of the sick and infirm children from such unions does not correspond to the general proportion." For the estimation of the influence of the marriage of relatives, the following observations are communicated: "In one country-parish of the Province of Pomerania, there are thirteen marriages between the children of brothers and sisters; among their descendants are neither deaf nor blind, with the exception of one who lost his hearing at the age of ten years by cerebro-spinal meningitis. Most of the children from these unions have developed as well, both bodily and mentally, as may be expected in a community in which excessive indulgence in whiskey was customary until recently. I have also received information from thirteen other marriages between the children of brothers and sisters or other near relations, among which is one between uncle and niece from which a blind child descended; but there an hereditary tendency may, perhaps, have coöperated. From another one of these unions, nine sons descended, all of whom would have been fit to serve in the royal guards, and one daughter of corresponding height and health. Of only one of these unions were most of the children imbecile or at least silly. The opinion, however, has been expressed by one of their kindred that the father 'had prayed them crazy.'"

Wilhelmi calls attention to the following historical fact in this connection: That marriages between the children of brothers and sisters were fully permitted by many nations

of antiquity, and points out that in many mythologies the gods wedded their sisters. "In the Mosaic law, the circle of forbidden marriages is a rather narrow one, so that those between the children of brothers and sisters are unhesitatingly permitted and are of frequent occurrence. Besides the marriages between ascendants and descendants, as well as brothers and sisters, it forbids only the union of the nephew to the aunt (*Lev.*, xviii, 6–18). The Roman rite, too, permits marriages between the children of brothers and sisters; but not, originally, that between uncle and niece—*quæ ad id tempus incesta habebantur*—(Sueton). When, therefore, the emperor Claudius, after Messatina's death, desired to wed his niece Agrippina, in opposition to all custom, he, so to speak, overcame the senate with a law, on the strength of which that class of marriages was thenceforth permitted. The ancient Christian church likewise did not oppose the marriage of relatives. But after some time the Roman Catholic church insisted upon her right to forbid even those of less intimate relations. The dispensation from these restrictions, however, was never refused, so that the impression is conveyed that these prohibitions had mainly the purpose of securing the fees of dispensations and to facilitate the meddling with family affairs. The Reformers at first continued the Catholic restrictions, but could not find any good grounds for them in the Bible; and thus it came about that these were gradually relaxed to the utmost, as no other considerations were opposed thereto."

From Wilhelmi's communications it resulted that 105 deaf-mutes descended from 60 marriages between relations, in the Province of Pomerania. These 105 deaf-mutes had 279 brothers and sisters with perfect senses. Therefore, of all the deaf-mutes in the province, 6.4 per cent. descended from marriages between relations, and 17.7 per cent. of the congenital deaf-mutes. Aside from the relationship, there was among these 60 marriages, 9 times deaf-mutism in the family; 3 times the father was deaf-mute; 3 times idiocy was present in the family; once the father was epileptic; once the mother was imbecile. Once 2 of the brothers and sisters had syndactylism.

In the District of Erfurt, 10 deaf-mute children issued from 8 kindred marriages. From such unions, therefore, 3.7 per cent. of all deaf-mutes, and 5.9 per cent. of congenital deaf-mutes, descended. The 10 deaf-mute children had 32 brothers and sisters with perfect senses.

2. FAMILY TENDENCY.

"This refers not alone to direct inheritance from parents, both or one of whom were deaf-mute, but also to inclusion in a family which, in its ascending (hereditary tendency in a more restricted sense) or lateral branches, had deaf-mute members. But the occurrence of imbecility and idiocy, of blindness and disturbances of the visual function generally, which were not traceable to an exclusively external cause, deserve here full consideration."

a. Marriages and Propagation of Deaf-mutes.

From 8 marriages between 2 deaf-mutes, 14 children with perfect senses and no deaf-mute issued. From 34 unions in which the father was deaf-mute, 54 with perfect senses and 3 deaf-mute children issued; from 36 unions in which the mother was deaf-mute, 58 perfect and 2 deaf-mute children.

Excluding unmarried parents and marriages complicated by blood-relationship, the Pomeranian statistics show that from 23 marriages in which 25 deaf-mutes were represented, 51 children issued, of which 7 died. In but a single one, were there 2 congenital deaf-mute children, and one woman besides had a deaf-mute child before marriage.

In the Erfurt statistics, 29 deaf-mutes contracted 24 marriages with 50 children, of whom 8 had died; all the surviving ones have perfect senses; 7 marriages are childless.

Wilhelmi draws the following conclusions from these facts:

"1. That deaf-mutes rarely transmit their deformity to their offspring. (Experience shows that later descendants are more endangered.)

"2. That the marriages of deaf-mutes in general are not very fruitful."

b. Deaf-mutism in the Family.

As in Wilhelmi's blanks it is not stated in all cases whether deaf-mutism was present in the family of the father or of the mother, I had to confine myself to the frequency of the family tendency generally.

126 children with congenital mutism descend from 77 marriages having a family tendency to deaf-mutism. From these figures, however, we must deduct 11 marriages with 16 children in which only impaired hearing occurred in the family. As the total number of deaf-mutes in both districts amounts to 1904, the percentage of 110 deaf-mutes from marriages with family tendency would be 5.7. Of deaf-mutes with whom the defect was congenital the percentage would be 14.5.

c. The Occurrence of Mental Affections in the Families of Deaf-mutes.

According to the two tabulations of Wilhelmi, there had been in the families, either on the side of the father or mother, mental affections in 37 deaf-mutes descending from 25 marriages.

The occurrence of blindness in the families of deaf-mutes was so rare, and the blindness in the few cases noted mostly acquired in the later years of life, that it cannot be brought into any connection with the deaf-mutism.

3. INEBRIETY OF THE PARENTS.

This was not especially inquired into, but the data are found in the question as to the diseases and infirmities of the parents. Wilhelmi considers inebriety of the parents as a very important factor in the production of deaf-mutism in the children, just as much as it was looked upon as the cause of idiocy in the children.

The records showed that in the Province of Pomerania the fathers of deaf-mutes were in 13 instances, and the mother in one instance, addicted to drink; of these marriages 20 deaf-mute children issued. In the District of Erfurt, we find 3 inebriate parents with 3 deaf-mute children.

4. OTHER DISEASES AND INFIRMITIES FROM WHICH DEAF-MUTES SUFFER.

a. Scrofula, Rachitis, Syphilis.

In the tabulation of Pomerania are found only 22 deaf-mutes with scrofulosis, 5 with rickets, none with syphilis; in that of Erfurt, 23 with scrofulosis, 3 with rickets, likewise none with syphilis.

From these meagre figures it might be argued that in most cases it had been neglected to state the complicating affection; these questions can be decided with some degree of accuracy only if the blanks are filled by physicians.

b. Paralysis.

14 deaf-mutes in the Province of Pomerania and 8 in the District of Erfurt were affected with paralysis.

c. Goitre.

Goitre is noted in 5 deaf-mutes in Pomerania and in 11 in the District of Erfurt. Wilhelmi lays stress upon the fact "that goitre and deaf-mutism do not by any means stand in the same relation to each other as, for instance, goitre and cretinism. In the Central Mountain chain, where goitre and "mountain neck" are frequent in all imaginable gradations, without, however, being conjoined with cretinism, I do not remember ever having seen it complicated with deaf-mutism. If a deaf-mute has goitre at all, it is an accidental coincidence of two morbid conditions, each of which not rarely proceeds from an hereditary tendency, but between which a direct causal connection could hardly be assumed."

d. Retinitis Pigmentosa and other Visual Disturbances.

From the Province of Pomerania are reported 12 cases of retinitis pigmentosa, some of which, however, are not quite certainly vouched for. Yet even among the indubitable ones are only two from kindred marriages; in one, in-

heritance is probable, but could not be definitely demonstrated. In the District of Erfurt are 3 deaf-mutes with retinitis pigmentosa; none of them descended from a marriage of near kindred.

Other disturbances of vision were found 29 times in Pomerania, 8 times in the District of Erfurt.

B.—ACQUIRED DEAF-MUTISM.

The causes are put together in the following table, from the more detailed communications of Wilhelmi:

TABLE XI.

	Stettin.	Cöslin.	Stralsund.	Erfurt.	Total.
Brain affections, incl. convulsions	152	105	34	43	334
Cerebro-spinal meningitis	100	165	13	4	282
Typhoid fever (?)	50	69	7	16	142
Scarlet fever	35	46	18	12	111
Measles and rubeola	25	18	3	4	50
Small-pox	4	5	1	2	12
Injuries of head	16	13	5	3	37
Ear affections	12	12	2	3	29
Other affections	28	23	4	8	63
Uncertain	27	33	7	4	71
	449	489	94	99	1131

Wilhelmi declares that the synopsis presented claims no great reliability, as in many instances causes and symptoms of affections were given as diseases; "nevertheless, it gives us some information, and does not exactly leave us in uncertainty as to the main issue."

The number of deaf-mutes in the Province of Pomerania in the year 1871, with a population of 900,000 in round numbers, amounted to 772, so that we had 8.6 deaf-mutes to every 10,000 inhabitants. A similar proportion is found in the later decades, while the present one is 11.4. The increase was caused by the epidemic of cerebro-spinal men-

ingitis prevailing in the north-eastern provinces of Prussia, "which in its devastating course through Germany, in the middle of the sixth decennium of our century, raged also to a fearful extent among the juvenile population of the Province of Pomerania (in some other provinces it was even more severe)." According to the table, 278 children in Pomerania lost their hearing through cerebro-spinal meningitis. "It is not to be doubted that these cases were correctly diagnosticated, but it may be assumed that the same disease has acted as cause far more frequently even. I judge so, not alone from the fact that in the blanks some other disease has not rarely been altered into cerebro-spinal meningitis by the correcting hand of a physician, but also from the conjecture that this affection may be hidden, so to speak, behind many cases designated as encephalitis, which owe their origin to the epidemic of cerebro-spinal meningitis. It is well known that nearly in every locality where the disease appeared the true nature of the first cases was not recognized, and the confusion with encephalitis lies near." "What I have said about mistaking cerebro-spinal meningitis for encephalitis holds good for typhoid likewise. There is a typhoid form of cerebro-spinal meningitis which in its course bears so close a resemblance to true typhoid that even the most expert diagnosticians were unable to distinguish between the two and often hesitated in their diagnosis. The number of 126 cases of typhoid in early age resulting in complete deafness appears to me extremely improbable, and does not at all conform to my own experience; indeed, it would be quite incomprehensible to me, were it not so evident that we must account for it on the ground of cerebro-spinal meningitis having been mistaken for it."

In the province, scarlatina is enumerated 99 times as the cause of deaf-mutism, and as measles and rubeola but very rarely so degenerate as to finally destroy the hearing, it is safe to assume that the greater part at least of the so-called 27 measles and 19 rubeola cases were in reality scarlet fever, especially as the terms "measles," etc., are promiscuously used by the people for acute exanthemata, while the desig-

nation of scarlet fever has gained but little currency in some localities.

Among the other causes, some cases of exposure should be mentioned. "A girl, now 16 years old, fearing a punishment her mother had threatened her with, remained out-of-doors during one October night, in her tenth year and was quite deaf the next morning. A farmer's son, now 33 years old, had fallen into a ditch in winter, when two years old; when rescued, he did not regain consciousness until after some hours, but thenceforth remained deprived of hearing and speech. A companion picture is that of an old man, now 71 years old, who had fallen into the water when five years old, was rescued in a state of syncope, and when restored was found and remained deaf."

By lightning stroke, a journeyman rope-maker, now æt. 36, lost his hearing in his eighth year.

In what year of Life was the Deaf-mutism Acquired?

TABLE XII.

	Stettin.	Cöslin.	Stralsund.	Erfurt.	Total.
In the 1st year	74	78	15	18	185
" 2d "	115	129	24	26	294
" 3d "	88	103	15	30	236
" 4th "	49	57	10	10	126
" 5th "	40	47	8	10	105
" 6th "	24	28	6	3	61
" 7th "	22	18	4	1	45
" 8th "	10	9	2	1	22
" 9th "	6	9	—	—	15
" 10th "	6	4	4	—	14
" 11th "	2	3	—	—	5
" 12th "	2	2	2	—	6
" 13th "	1	—	2	—	3
" 14th "	2	—	—	—	2
" 15th "	2	—	—	—	2
In later years	4	—	1	—	5
Not determined	2	1	1	—	4

From the table it appears that deafness occurs most frequently in the second and third years of life. It must seem

questionable whether those who lost their hearing after the fifteenth year, have been rightly included in the list, because at that age speech is ordinarily not lost again, so that they mostly can be said to be deaf only. Among those enumerated as having become deaf in later years, I find even two of the age of 32.

"Concerning the time from the earliest infancy to the close of the first year, we cannot, by any means, look upon the causes given as always strictly correct; indeed, they are rather to be doubted, mistakes being very liable to occur; such deaf-mutes as have lost their hearing through sickness in early life, the importance of which was not recognized, perhaps being regarded as deaf-mutes from birth; or else, congenital deaf-mutes, who have been attacked by some disease in infancy, being looked upon as such with acquired deaf-mutism."

Other Diseases and Infirmities from which Deaf-mutes Suffer.

As affected with scrofulosis, 65 with acquired deaf-mutism are reported from Pomerania; 11 from the District of Erfurt; with rickets, only 5 altogether. 52 in Pomerania, and 3 in Erfurt, had paralysis. Repeatedly it was stated of deaf-mutes in Pomerania, that they had been paralyzed in consequence of their sickness, particularly cerebro-spinal meningitis, but were now cured.

No case of retinitis pigmentosa was indubitably proven in any one with acquired deaf-mutism, either in the Province of Pomerania or the District of Erfurt. Eight doubtful cases were reported from Pomerania. Suffering from other visual disturbances were, in Pomerania 30, in Erfurt 7, of those with acquired deaf-mutism. Altogether there were in the Province of Pomerania 5 blind deaf-mutes, several besides being nearly blind. Three blind deaf-mutes were reported from the District of Erfurt.

ON THE DISEASES OF THE EAR IN LOCOMOTIVE ENGINEERS AND FIREMEN, WHICH MAY ENDANGER THE TRAVELLING PUBLIC.

By Prof. S. MOOS, Heidelberg.

Translated by James A. Spalding, M.D., Portland, Maine.

(A paper read before the second International Otological Congress, at Milan, Sept. 2, 1880.)

During the last few years I was consulted for diseases of the ear by four locomotive engineers who had already resigned their posts for other reasons. These cases had this in common: that all four dated the origin of their deafness to the time when they still pursued their calling, that both ears were affected, and that the hearing was greatly diminished. Two of them suffered from constant subjective noises in both ears, one in one ear only, while the fourth heard no subjective noises at all. All four cases could be classified under the heading of *the sclerotic form* of catarrh of the middle ear.

This fact led me to turn particular attention to the subject in question, *especially as similar observations which I have since made in the case of locomotive engineers and firemen who were still on active duty*, had brought so vividly before me *the danger which these affections might cause to the travelling public.*

It is now nearly thirty years since the French railroad surgeons began to pay more particular attention to the health of the employés.* Dr. Lent considers the paper of

* The following notices are taken from the papers by Dr. Lent, of Cologne, entitled, "*Statistics of diseases in railroad employés.*" (*Correspondenzblatt des Niederrheinischen Vereins für öffentliche Gesundheitspflege.* Bd. iv, vi, vii and viii.)

Duchesne* more of theoretical than practical value, for it confines itself exclusively to the influence of railroad occupations on the health of locomotive engineers and firemen. To me, however, as concerns the subject now under consideration, it seems especially worthy of note, that Duchesne in his preface mentions, although in a theoretical way, the various *possible* influences of these occupations on health, and in so doing cites all the organs which may thus suffer, *except the organ of hearing;* on the other hand, he thinks that the "*brain*" may be affected by the noise and whistling without causing any mental derangement. It is only at the end of his book, that Duchesne calls attention to the diminution of vision, and *more or less complete loss of hearing.*

C. Devilliers† speaks chiefly of the diseases of railroad employés. His period of observation embraced fifty-four months, with 13,588 employés and 13.92 per cent. cases of disease. The most noteworthy point in this accurate statistical work, is its opposition to Duchesne's opinion that the vision and hearing of engineers and firemen can become affected.

v. Weber has written the most important German work‡ upon this topic. He emphasizes a rapid organic decay and invalidism in factory and railroad employés.

The chief noxious influences mentioned in this work, are the excessive perspiration caused by the heat of the furnace, the draft of air, the outpouring of smoke when the furnace is opened, as well as the consequent inhalation of considerable quantities of oxide of carbon gas, carbonic and sulphuric acid, all of which may cause catarrh. Additionally, we have the violent current of air caused by the rapid motion, as well as the direct wind, rain and snow which strike the overheated body. The shriek of escaping steam

*E. A. Duchesne. "*Des chemins de fer et de leur influence sur la santé des mécaniciens et chauffeurs.* Paris, 1857.

† "*Récherches statistiques et scientifiques sur les maladies des diverses professions du chemin de fer de Lyon.*" Paris, 1857.

‡ "*Die Abnutzung des physischen Organismus beim Fahrpersonale der Eisenbahnen.*" *Weich's Illustrirte Deutsche Gewerbzeitung*, 1860. *Heft.* v and vi.; and "*Die Gefährdungen des Personals beim Maschinen- und Fahrdienst der Eisenbahnen.*" Leipzig, 1862.

and the noise of the train affect the brain and nervous system; no mention is made of the hearing. According to v. Weber, liability to disease increases with years.

Observations based on these formulæ were made and published* by a number of Prussian state railroads. In them we find for the first time, as well as in all later publications, an especial column for diseases of the ear. In the tables for the Lower Silesian R. R. for each year, we find an average for the years 1851–1858 of 0.08, and for 1859–1864 of 0.07 of diseases of the ear amongst every 100 engineers and firemen; on the Bergen-Mark R. R., 0.00 per cent. for the same employés for the years 1862–64.

The statistical treatment of this topic was advanced one step further by a discussion at the Congress of the German Union of Railroad Directors at Vienna in 1869, and at Frankfort-on-the-Main in 1873. The latter congress agreed upon a formula to serve as a basis for statistical collections of the frequence, form and duration of diseases in railroad employés; this, the congress decided to accept and to recommend for use to the associated authorities. In this form it is interesting to see *a special column for engineers and firemen, as well as for diseases of the ear.*

The best and most accurate work which has since been published on this topic is that of Dr. Lent (l.c.), which embraces the statistics of disease on several railroads, from 1873 to 1878. During this time there were noted 74,500 cases of disease resulting in 939,659 days of incapacity for duty. The tables show striking variations in the relative frequency of disease, as well on the several railroads as in the individual occupations.

Locomotive engineers and firemen are most exposed to danger, by service on the engines; then porters, conductors, and brakemen, who are exposed about twice as much as the remaining classes of employés; they also show the longest incapacity for duty. The most noticeable point as regards the causation of chronic diseases of the ear, is the high percentage (25 per cent.) of diseases of the respiratory organs, and the proportionally slight percentage ($\frac{1}{3}$ per cent. to $\frac{1}{2}$

* "*Ueber die Abnutzung des physischen Organismus beim Fahrpersonale der Eisenbahnen mit besonderem Bezug auf v. Weber's Aufsats.* Berlin, 1866.

per cent.) of diseases of the ear, while diseases of the eye reach 2½ per cent. But inasmuch as *incapacity for duty* is taken as the basis of these statistics, it is evident in all these cases that the tables only show the *acute* transitory diseases, while they leave unmentioned the cause, the degree, and the frequency with which the acuteness of hearing in engineers and firemen is permanently affected by their occupation.

We can only obtain a complete review of the literature of the subject under discussion by a résumé of Ludwig Hirt's book*. In order to gain an unprejudiced opinion, Hirt travelled repeatedly on the locomotive. His longest uninterrupted journey covered 235 English miles. He notes the following causes which *act on engineers and firemen when travelling:* (1) The violent concussion; (2) the uninterrupted straining of the eye and ear; (3) the cutting air (less noticeable on the new engines provided with a protecting roof); (4) the continuous erect position; (5) the frequent change of temperature. The occasional troublesome or noxious influences are: (1) dust; (2) irrespirable and poisonous gases, particularly CO.

Hirt observed on himself and young firemen an increased frequency of pulse and respiration, pain in the knees and calves of the legs, exhaustion, weariness, and excessive thirst and nausea, which, however, soon disappear. Whenever he travelled 35 to 50 miles without a stop vertigo was perceived, associated with violent roaring in the ears, and he felt the urgent need of something to cling to. In addition to these symptoms we have, in the case of engineers and firemen, the mental exertion of the most careful watchfulness and uninterrupted exertion of the higher organs of sense. Regarding the *results of long years of travelling on the engine*, Hirt says that, taking all in all, an engineer who averages 75 miles daily—in round numbers 25,000 miles a year—*may* be as sound and robust after 20 years' service as he was in the beginning, provided that he was then healthy and that he has met with no accidents. "If we examine," says Hirt, "a large number of engineers who have been

* "Die Krankheiten der Arbeiter." Abth. I, pp. 126–131. Breslau, 1871.

long in the service, we find that a majority of them are robust, sunburnt men, with well-developed faculties, good digestion, and in a state of health which in spite of all noxious influences leaves nothing to be desired." In a majority, we say, but the minority, in whom we see the disastrous results of their calling, must not be forgotten.

Our paper concerns this minority, *these exceptional cases*, and they will be found important.

At this point I will describe five of my own cases, the details of which will throw some light upon the weighty subject now before us:

CASE 1.—B. S., æt. 41, a locomotive engineer, February 24, 1878, has been deaf in both ears and subject to continuous tinnitus for five years. He ascribes his trouble to repeated colds caught while on duty.

Examination shows: Right *Mt* normal; left, retraction of the handle of the malleus, and opacity of the mucous membrane. Politzer's acoumeter, right 0.9, left 0.7 *mm.* (normal distance 15 *mm.*). H is therefore reduced to about $\frac{1}{15}$ normal. I never saw the patient again.

CASE 2.—J. K., æt. 47, locomotive engineer, was sent to me for an opinion on the condition of his ears. Two opinions had already been given in the case, one of which declared that K.'s hearing was normal, the other that it was impaired.

November 9, 1879. K. has been an engineer for many years; in later years on the Kinzig Valley R. R. He declares that his hearing has become much affected, during the last two years, from travelling through the tunnels on this road. He says that his hearing has decreased, and that he has had frequent colds, accompanied with pain, roaring and ringing in both ears. The subjective noises and deafness have always been worse after a journey on the engine.

Present state: Right *Mt*, light-spot absent, mucous layer opaque, with a small atrophic spot beneath the handle of the malleus; left *Mt*, light-spot absent, vessels of manubrium injected, partial radiating opacity in the anterior inferior quadrant. Bone-conduction is still present on both sides for the acoumeter, which cannot be heard by aerial conduction; it is also absent for high tuning-forks, but present for the low fork. Voice, 1 *m.*

Leaving aside the thoroughly trustworthy history of the patient—increase of the subjective noises and transitory decrease of hearing after travelling through tunnels, loss of function in the ears from duty on a railroad so abundant in tunnels—the local examination left nothing to be desired, and I therefore gave an opinion to the effect that the man was hard of hearing.

I was quite ignorant at that time why I had been asked to act as referee in this case, but I have since learned that the patient had caused a collision with another train while making up his own, thus doing considerable damage. Up to this date, I do not know the result of the official investigation. Still I do not doubt but that my opinion saved the man from a penalty; on the contrary, I even hope that, instead of being discharged, he will receive a pension, which, in my opinion, he justly deserves, for his hearing was damaged while he was on active duty.

Case 3. *December* 4, 1879.—M. S., æt. 30, a locksmith, who acts as a reserve engineer for switching and making up trains, *has been deaf for eight days.* He has nasal and middle-ear catarrh on both sides. Acoumeter, *R*, 0.5; *L*, 0.2 *m.* Both *Mtt* are concave, but otherwise not much altered. The treatment lasted till March 10, 1880. Result, —H, both ears, acoumeter, 0.5 *m.*; voice, 4 *m.* The patient now being desirous of a definite position as an engineer, asked for a favorable opinion as regards his hearing, in which we *emphasized the fact* that his hearing was but $\frac{1}{20}$ of the normal; hence his preferment had to be refused by the management of the road.

Case 4.—R. B., engineer, æt. 30, consulted me December 18, 1879, for deafness of several years' standing. He suffers from tinnitus, especially in the morning. Until within a month, the patient had been a fireman for eight years; since then, a reserve engineer. *When the train is composed of more than twelve cars, he cannot hear the signal whistle from the extreme end; he can only hear it four-car lengths.* He has suffered for years from pharyngeal catarrh.

Both *Mtt*, light spot absent; mucous membrane, opaque: H, both ears, loud voice, 5 *m.*; whisper, right, 1 *m.*; left, 0; acoumeter, right, 0.10; left, 0.04 *m.* Tuning-fork better right than left.

Diagnosis.—Chronic pharyngeal and middle ear catarrh. Treatment lasted till January 2, 1880. H, acoumeter, right, 0.15 ; left, 0.10 *m.* The patient had been provisionally suspended from duty, owing to a letter which I sent to the superintendent.

CASE 5.—M. G., æt. 65, a locomotive engineer, came to the clinic July 10, 1880. He has been in the service 24 years ; for the first two years as a fireman, then eight years a reserve engineer, and for the last 24 years an active engineer. He looks robust, has never been sick, *and only deaf in his right ear, and this one only since early this morning*, when he drove a train for two hours. On his return he became deaf in the right ear, and heard his voice like an echo (resonance of voice dependent on the aural affection).

Examination of the right ear.—Hyperæmia of the upper wall of the auditory meatus, extending to the vessels of the manubrium ; increased brilliancy of the *Mt.* H, for voice and acoumeter, only close to the ear. Left ear, *Mt* opaque, and more concave than normal ; manubrium horizontal ; posterior fold of *Mt* prominent. H, voice, 2 *m.* ; acoumeter, close to the ear.

After Politzer's experiment the resonance in the right ear disappeared, and H increased to voice 3 *m.*, but remained unaltered in the left. This was, therefore, an evident unilateral increase of an affection of both ears, which had lasted for a long time, and could be attributed to the age of the patient, or to his occupation, or both combined.

At all events, the deafness seemed sufficiently marked for me to emphasize to the superintendent *the great danger which might ensue were the patient put on active duty, even after removal of to-day's transitory disturbance.* Even if this deafness had not appeared, the man who thought that he heard perfectly well (!) and was otherwise healthy, might have remained on active duty for a long time, and possibly until some catastrophe had been caused by his diminished acuteness of hearing.

I have thus far seen ten cases of marked disturbance of hearing in engineers and firemen, a number, however, which is altogether too small to decide the following questions: Are there certain disturbances of hearing peculiar to these occupations? Are they, perhaps, more frequent than would appear from my observations? Do they appear at a proportionately early date—that is to say, after a few years, or

only after many years? Does the affection, when once present, increase more rapidly, owing to the noxious influences peculiar to this occupation, than in other occupations? Are locomotive engineers and firemen who work on railroads with numerous tunnels more exposed than others? Or does the affection, when once pronounced, increase more rapidly in these men than in those who perform duty on railroads running through level countries?

Although these questions can only be answered satisfactorily by numerous statistics obtained by the united efforts of skilful observers, I will here venture to offer some remarks on several of the points in question.

When we remember that direct labyrinthine affections occur in persons whose calling exposes them to constant work amidst loud noises, *e. g.*, locksmiths, blacksmiths, boiler-makers, tinsmiths, telegraphers, machinists, etc., it is surprising that nothing of the sort could be discovered in my cases. It seems incredible that they do not appear, when we consider what is exacted year after year from the organ of hearing by the continuous crashing of the train, the repeated hissing of escaping steam, and the thousand repetitions of the scream of the whistle.

Schwartze observed deafness for high tones, due to the whistle of a locomotive, while my own experience embraces but one case of such deafness in an engineer from the following accident: While an engine was running at high speed, the steam sack of the whistle was torn away inside the cab, and the leak could not be closed. This caused such a tremendous noise that the engine had to be changed. The engineer's hearing was diminished for a fortnight, with excessive tinnitus. The case was cured spontaneously and gradually.

Patients who suffer from subjective noises often say that the extremely complicated noises incident to railroad travel cause transitory sympathy on the part of the auditory nerve and its terminations in the labyrinth, so that they hear worse, and their subjective noises are louder, after long journeys by rail.

I will also mention that I have seen two cases of Mén-

ière's disease (in which, as we know, the labyrinth is affected), one of which originated on a railroad journey from Nice to Zurich and Heidelberg, while the other had a relapse after a long journey by rail.*

In addition to these noxious influences, the chief rôle is played by those which have been *partially* mentioned by other observers and cited in our introduction. Amongst these we note especially the sudden change of temperature of the skin, which is due to excessive perspiration while firing up, from the sudden entrance and passage of long or numerous tunnels after the body has been exposed to the bright sun; further, we have the direct wind, rain, or snow, which strike the body, all of which lead to the high percentage (25 per cent.) of diseases of the respiratory organs in engineers and firemen. But diseases of the ear, the middle portion of which belongs, from anatomical and physiological grounds, to the respiratory tract, are frequently observed in connection with diseases of the respiratory organs.

When this affection of the ear is once established, the influences just cited act prejudicially and diminish the hearing more or less rapidly if the patient continues his occupation, or the hearing sinks gradually and unnoticed until it no longer fulfils the indications of the service. Under certain circumstances this may be the case with proportionally good hearing. Consider only that the service presupposes an exceptionally good hearing, especially at night; that the employés are often called upon to notice suspicious noises at the right time; in short, that there are situations in which *moderately good hearing*, which would be quite sufficient for most employments, must be considered inadequate under circumstances which may lead to danger. Who can say whether many an unexplained accident may not have been due to this fact?

I have had too little experience as regards the possible injury of hearing from travelling through tunnels, but it is worth noticing that one patient (Case 2) with marked deafness declared that his hearing had been injured by the fre-

* Compare, "On the combined appearance of disturbances in the eye and ear." These ARCHIVES, vol. vii, pag. 481.

quent passage of tunnels, especially during the last two years.

As regards the *frequency*, I will here give room for the expression of one engineer (Case 4) while undergoing repeated tests, without, however, guaranteeing its accuracy: "*If all of my fellow-engineers were tested as I have been, more than one-third of them would be found deficient in hearing.*"

If affections of the ear in engineers and firemen are not so frequent as in others exposed to similar noxious influences, *e. g.*, hunters, foresters, machinists, etc.; if extensive statistics yield but a proportionally small percentage; and, further, if these diseases appear only *rarely and exceptionally* in these men, nevertheless the exception is important enough for aurists, in conjunction with competent authorities to give the subject full attention in the future; for even the exceptional cases might lead repeatedly to danger for those who travel by rail.

CONCLUSIONS.

I.—*Locomotive engineers and firemen are liable to affections of the ear with noticeable decrease in hearing, usually on both sides, which may be attributed to their employment; these affections may, perhaps, appear earlier in those who are employed on railroads running through mountainous regions than in those on roads in level countries.*

II.—*This acquired deafness appears to be more dangerous than color-blindness as regards the signal code,* because the latter is a* CONGENITAL *defect, which can be defined precisely before the individuals are put on active duty, while the deafness is an* ACQUIRED *disease, slow in its approach, and often unknown to the person affected, until an accident, e. g., a cold, or injury, diminishes the hearing more and more on one or both sides, or destroys it completely.*†

* For the practical importance of color-blindness, compare the works of Holmgren, Stilling, Cohn, Jeffries, etc.

† See Case 5. I have reported a similar case (these ARCHIVES, vol. viii, p. 332), "On a traumatic movable hæmatoma of the membrana tympani." An engineer was wounded in the following manner: An empty bottle was thrown from the window of a car travelling in an opposite direction, and hit the man's

III.—*The percentage of these affections of the ears can only be fixed by extensive statistics and examinations. The fact of its existence is evident, and even if the percentage were but slight, it is of great importance, for even a single exception may cause danger.*

IV.—*The ears should be examined very carefully before a certificate of fitness for duty is given; the examination can and should only be undertaken by a physician who has made a special study of otology, or, at least, understands how to examine the ear and to test its functions accurately.**

V.—*When a man has acted as fireman for a long time, his promotion to the position of engineer should demand especial precautions in this respect.*

VI.—*When his definite appointment has been made, he should be warned that his occupation* MAY *injure his hearing, and that he should present himself for examination when he notices the slightest defect in this respect.*†

VII.—*The physician should be sworn to report every case of deafness in firemen or engineers to the superintendent of the road.*‡

VIII.—*The hearing of engineers and firemen should be tested at least once in every two years, so as to avoid all possible danger; perhaps oftener in those who run on tunneled roads.*

---

left ear. Sixty-five days later, I could still see the results of the wound in the left *Mt*, and at the same time prove that the *injury had happened to an ear which was no longer normal; the hearing on the uninjured side was also exceedingly diminished. This engineer had no idea of such a state of things. He was pensioned.*

* Government or private railroad corporations should keep their own interests in view in the appointment of surgeons for these examinations. They would be acting for their own advantage in preferring one who has made a special study of otology.

† The multiplicity of positions on railroads gives numerous chances for employing deaf men otherwise than in the positions in which their hearing became affected, but even a discharge from active duty on full pension amounts to nothing in comparison with the damages for goods and loss of life which might depend on deafness for signals. Think also of the enormous sums often paid for damages in cases of accidents.

‡ The German law is very defective on this point,

DIPLACUSIS BINAURALIS. SELF-OBSERVATION.

By Dr. J. A. SPALDING, Portland, Me.

February 19, 1880, I went into a shoe manufactory about 4 P.M., and stood for several minutes with my left ear exposed to the loud noise of a machine used in embossing the seams made by the sewing machine. All at once I perceived a sensation of fulness and ringing in both ears. The ringing noise seemed to me to have the pitch of g^1, and resembled the whistle of a locomotive engine when heard at a distance. The feeling of fulness lasted for a long time, in spite of Valsalva, but as soon as I reached my office and could perform Politzer's experiment it was much relieved. The ringing, fixed as g^1, continued in the left ear, while in the right it gave way now and then, at irregular intervals, to a roaring sound like the distant sound of the ocean, which was likewise intermitted by a throbbing noise such as I have often noticed after violent exercise.

About 7 P.M. I happened to be whistling a tune, when I noticed, on striking a note near g^2, that I heard a second and different note in my left ear, where the ringing g^1 noise still continued. This note seemed to be in the tympanum, as nearly as I could locate it, and yet it sounded as if coming from a great distance. On testing further with a flute, the only instrument at my command, I found that the notes g^2, g sharp^2, a^2 and a sharp^2 were normal in the right ear, while in the left ear they were a minor third above, *i. e.*, I heard g^2, g sharp^2, a^2 and a sharp^2 in the right ear, b flat^2, b^2, c^3 and c sharp^3 in the left ear. No other tones in the whole compass of the flute produced any such sensation in the left ear. The line of demarcation was very sharply defined, f sharp^2 being heard alike in both ears; b^2 the same. This phe-

nomenon was noticeable even when I breathed into the flute, and opened the keys for the notes above mentioned, but it became more marked when the notes were played more forcibly. I noticed the same phenomenon when *singing* the notes above mentioned, only it struck me that the false tones in the left ear were pitched an octave higher than my voice. The tuning-fork a^1 did not give the false tone in the left ear, except when struck very forcibly and rested upon the *right* mastoid process. [I should mention here that, owing to deafness from otitis media catarrhalis chronica, I hear a tuning-fork much louder by bone-conduction than when held even very close to my ears.] I usually hear the tuning-fork best in my left ear by bone-conduction, no matter whether it is placed on the forehead or mastoid processes, or between the teeth ; but during the continuance of the false tone in my left ear, the tuning-fork was heard louder in the right ear, when touched to the forehead and teeth. The a^1 tuning-fork was the only one at my disposal.

At 11 P.M the false tone was not perceived on striking g^2 on the flute, though it remained for g sharp^2, a^2 and a sharp^2, and now included b^2, where it had not been heard before. The roaring sound in the right ear had disappeared. During the whole time of observation the hearing did not change at all, although tested repeatedly by watch, clock and voice.

I will mention that while in the shoe manufactory I felt a momentary vertigo, which was, however, so slight that I did not recall it, except when thinking over the events of the afternoon, while testing the false tone in the left ear. This false tone lasted till midnight, when I went to bed. On rising the next morning, I took my flute, touched the notes affected last night, but the false tone in the left ear had disappeared. The only sensation in my ears was the ringing, with occasional roaring, that I have endured for twenty years.

Finally, I would answer the questions suggested by Dr. Knapp (ARCHIVES OF OPHTHALMOLOGY AND OTOLOGY, vol. i, page 374) as follows :

1. The difference in pitch between the tones was a minor third.
2. The false tone had the same intensity and timbre as the tone heard by the better ear.
3. The differences of pitch were constant.
4. The false tone was higher.

5. I cannot answer, from lack of suitable tests.
6. The range of double hearing was four notes only.
7. The limits were *very* distinct.
8. Has the same answer as 6.
9. It is impossible for me to decide the cause, only I would suggest an *increase* in labyrinthine pressure as being more likely to cause an increased pitch in the notes affected. At all events, whether increased or diminished, the change of pressure in the labyrinth must have been secondary, and dependent on some sudden change in the middle ear, because the feeling of fulness in the ears appeared first, and was almost immediately followed by the ringing sound in the ears and very slight vertigo.

AN INTERESTING CASE OF PROTRACTED DEAFNESS CAUSED BY THE REPORT OF A MUSKET. WITH REMARKS.

By Dr. GUSTAV BRUNNER, of Zurich.

(Translated by Dr. L. E. Rade, of New York.)

The following observations seem to me, in many respects, not unworthy of publication, since they furnish material for the solution of a few problems which remain unsolved.

The patient is a woman, 36 years of age; up to the time of the accident, healthy and enjoying normal hearing. As I was not consulted until the sixth week of her trouble, I requested her to write the history of her case, which I will give before going further.

She writes: "On the 28th of February, 1873, I was in a narrow, low room, when outside a musket was discharged, near the window on my left side. Instantly I experienced in my left ear a clap which moved whirring and whizzing to the right ear; after that I became dizzy, and heard nothing beyond a violent roaring in my head. This agonizing condition having lasted a couple of hours, I began to hear or rather feel certain noises, as, for instance, footsteps; but everything had a peculiar sound, like the shaking of a window after the discharge of a cannon. Moving an object in the room made the impression as if the wheels of an old rusty clock-work were grating against each other. It came to my ear with a whistling and croaking sound which was almost unbearable. By degrees I understood people who spoke to me, provided I could watch their faces, but their voices appeared damped, and every sound caused the same shrill croaking in my

ear. My own voice produced such a loud noise in my head, that I refrained from speaking.

The following morning (24th of February) I heard the singing of a bird, but in every other respect the conditions were the same as on the previous evening. When playing the piano I heard the strings vibrating as if they were muffled, but could not distinguish a single tone. On drawing my fingers across my temples, I heard a sound like that produced by filing an iron bar. Feverish excitement with violent headache came on and lasted three days, during which time I remained in bed almost continually, but could not sleep. I suffered with violent pulsations in my head as though it would burst, and heard an incessant noise, resembling the roaring of water in closed waterworks.

By degrees the fever abated, and on the 27th day I heard the ringing of the church bells for the first time, but they all sounded as if they were cracked. On the 8th day there was another relapse with such violent headache that I had to go to bed again, *feeling* sounds rather than hearing them. For a few days I passed most of the time in bed. Little by little, however, the hearing in the right ear returned, and with the left ear also I gradually began to hear (in the middle of the second week), but the noise in the head continued.

On the 6th day of March the family physician ordered camphorated oil to be dropped into the ear three times a day, which was always painful and caused a sensation of burning in my ears as if they were inflamed. This feeling increased day by day. The noise in the head changed sometimes to the howling of a tempest, and sometimes to the ringing of a great number of church bells, which was succeeded again by wave-like noises. Immediately after dropping the oil into my ear, I heard a humming as if I were in a beehive.

During the fourth week a little cerumen made its appearance in the right ear, and from that time forth I could hear as well as to distinguish musical tones. The tones of the once and twice marked octave, pained my left ear so that toward the end of the fifth week it was so much worse that I feared losing the hearing on the left side entirely. Everything sounded obtuse, and I felt violent burning pains. When I speak, and especially when I eat, I have a sensation in my left ear as if something would open and become entangled with my voice. My own words echo loud and painful in my ear, on account of which I prefer to remain silent."

Thus far the patient's narrative. I saw her on the 37th day of her disease (the 31st of March) for the first time, and found that though the improvement had made quite an advance, the faculty of hearing and understanding the human voice was still impaired to a considerable degree. When I spoke in the ordinary tone of conversation, she could hear distinctly only at a few feet. With the right ear she heard my anchor-watch at a distance of 160 *cm.*; with the left ear, at a distance of 80 *cm.* (normal 500 *cm.*). The membrana tympani showed nothing abnormal. The bone-conduction was still defective, the smaller tuning-fork (for instance, the common ā) not being heard from any part of the skull, the large prismatic c^1 fork *only when struck hard*, and then not very distinctly. When placed before the ear it was heard well, but gave a higher tone when held before the left ear than before the right (the patient judged the difference to be a little less than half an interval). I ordered rest for the diseased organ above all things, cupping over the mastoid process, and bitter-water. Since that time I saw the patient three times, on the 7th and 27th days of April, 1873, and on the 29th day of May, 1875. There had been gradual improvement, but still she suffered during the month of April with considerable headache, subjective noises and frequent dizziness. Both ears were occasionally very sensitive to loud sounds and noises, especially the left.

On the 27th day of April, the 64th day of the disease, I made the following note: Patient feels her head a little clearer and understands speech a little better, the distance at which the anchor-watch can be heard is for the right ear, 250 *cm.*; for the left, 85 *cm.* If sounded loud the c^1 tuning-fork is heard a little better when placed upon the skull than on the 31st of March, *but much less distinctly than when held before the ears.* The fork placed upon the vertex is heard better on the left side; on closing both auditory canals, better on the right. It still has a higher pitch before the left ear than before the right. The application of Politzer's bag causes the air to enter both ears pretty normally, but makes no change. The patient hears the tones of the piano clearly, when using one ear at a time (very weak with the left), and false, when using both simultaneously. The once and twice marked octaves are not so unpleasant to the ear as before. On taking between the teeth a stick which is connected with the sounding-board of the piano, she hears the tones and chords better on the left side and clear, but very subdued, as if the

sound passed through closed doors. The subjective noises are still present, especially when everything is quiet, but when there is much noise in the room she hears them less. At present they are more in the ears themselves, and she can listen to them, whilst before they seemed to fill the whole head, confusing the sounds which entered from without.

Two years later, on the 29th of May, 1875, I saw the patient once more, the distance at which the anchor-watch could be heard was 500 *cm.* on the right side; 180-200 *cm.* on the left. She understood speech a great deal better. Of the consonants she heard the letter *s* best, then *f*, *r*, and *p* less, but as for other alphabetical sounds, she mistook vowels and consonants alike. All tuning-forks were heard *much louder when held before the ears* than when placed on any part of the skull (teeth included).

Remarks.

1. This case evidently represents *a lesion of the labyrinth*, together with irritation and hyperæsthesia of the acoustic central organs, caused by a violent concussion. The whole picture of the disease, viz., the total deafness in the beginning, the excessive hyperæsthesia, the loud subjective noises with headache, vertigo, insomnia, and nervous excitement, does clearly point to that diagnosis, which is also confirmed by the condition of the bone-conduction. It is impossible to describe precisely in what the lesion of the labyrinth consists in such cases, but so much is certain, that we have to deal not only with an over-excitement of the nerves, caused by a violent acoustic impression, but *with a concussion of the whole labyrinth by a violent mechanical force*, probably also with a tearing and bruising of the softer parts, giving rise to considerable inflammation, perhaps also more or less to hemorrhage. Milder cases, in which the symptoms disappear within a few hours, might be designated commotio labyrinthi. Attention must be called also to the *succession of the symptoms* in this case. Not until the second day did feverish excitement, with violent pain and pulsation in the head, set in. These were accompanied by an incessant noise, which the patient compared to the roaring of water. This may have indicated that the inflammatory reaction in the labyrinth required a certain time to

develop itself as is observed in any other injury. We shall probably not err in considering the simultaneous roaring chiefly as a vascular noise, brought about by the inflammatory congestion in the ear. This explanation is substantiated * by the low pitch of tone—in contradistinction to those other shrill and yelling noises.

2. *The loss of the capability of perceiving tones is very interesting.* The patient heard only the striking of the keys of the piano, but not a trace of a tone. In the fourth week she began to distinguish them again.

According to the current view which assigns separate organs in the labyrinth to tones and noises, the concussion had rendered the cochlea unfit for performing its function. It is true, the cause might also be looked for in the brain, and in the present case a transient paralysis by too great an irritation might be thought of, but if we consider the nature of the trauma, it is hard to explain why the tone-perceiving district *only* should have suffered and not the central part for noises. It is also more probable, that we have a concussion of the auditory organs rather than an increased nervous excitement. We will, therefore, have to look for the greater disturbances in the labyrinth, it being more directly exposed to the shock, than the brain where there seems to have been only a high degree of hyperæsthesia. Similar cases are not so very rare, as, for instance, in partial tone-deafness,† but I have never seen a case where perception of noises was also lost.

Are we to conclude, therefore, that the apparatus for perceiving tones on account of its delicacy of structure is more liable to disturbance than the rest of the labyrinth?

For these reasons it will be hard to find an acoumeter which would meet all requirements, as we would have to test for tones and noises separately. It is also known that we have no universal meter for all patients, especially for their difference of hearing. Worthy of notice is also

* Helmholtz lately is inclined to look upon the muscular noise as a resonance in the ear, caused by the contraction of the muscles. If this be true, it is probable that blood-sounds in the ear are modified (resp. lowered in tone) by the tone of its own cavities.

† In Moos' case published in Virchow's *Archives*, transient deafness from a box on the ear. The faculty of perceiving noises increased above the normal.

3. *The peculiar yelling additional sound* * which in the beginning accompanied all tones and noises, and, corresponding to the violence of other symptoms, was of almost unbearable intensity. The voice of other people was heard indistinctly, and she could understand them only by the aid of her eyes, and yet every sound was accompanied by a yelling noise which she compared sometimes to whistling and croaking, sometimes to rusty wheel-works, and even to the shaking of windows when a cannon has been discharged. This is a symptom which I have rarely found wanting in similar cases, with this difference, that it was not so pronounced, and concerned more the higher tones,† as I could observe in my own ears.

I think an interesting observation by O. Wolf belongs here also,‡ where deafness set in suddenly after a violent spell of sneezing, probably from the same source, viz., violent concussion of the organs of hearing. On the seventeenth day of the disease, when the roaring, which was very intense in the beginning, had somewhat subsided, "peculiar resonant sounds accompanied the whistling and singing of high tones (c^2–g^2 of the piano)." Wolf calls this symptom simply a phenomenon of resonance, without giving any further explanation. Hemorrhage in the labyrinth was thought to be the probable cause.

How is this phenomenon to be explained? Is its origin in the middle or internal ear, or still deeper in the central organ? In the present case, I would rather refer it to the intense *hyperæsthesia* of the central organ of hearing, which would leave unexplained the additional sound which, instead of being more or less heightened, was described as metallic rattling and yelling. Does this occur from the fact that our ear, resp. central organ, is more easily impressed by high tones than by low ones, or for some other cause? This I am unable to decide, and would refer

* The same is mentioned in an observation by Blau (ARCH. f. O., xv, 226), which I could not make use of any more.

† Compare my paper: On the symptoms which are caused by the report of fire-arms. *Mon. f. Ohrenh.*, 1873, No. 4. "Tones and noises coming from without were accompanied by a high metallic sound. This was especially the case with my own voice and on whistling in the higher octaves."

‡ ARCH. OF OPHTHAL. AND OTOL., vol. iv, p. 273.

to my remarks on the probable cause of ringing in the ear.*

The discussed symptom does not seem to be so very rare, notwithstanding the fact that it is seldom mentioned.

I am now treating a lady for the sequels of an otorrhœa from which she suffered in her youth (viz., defects in the drumheads with calcification and atrophy). Pouring in lukewarm water caused on one side quite an intense inflammation of the middle ear, with great heaviness in the head and intense sensitiveness to noises. This patient, who is not at all nervous, for the first few days complained that every tone produced a "brazen" metallic sound in the ear, which was very annoying to her. I am inclined to refer this symptom to hyperæsthesia acustica in this case also. Perhaps it belongs entirely to the regular train of symptoms of this condition.

In other cases a different view may have to be taken. We know, for instance, nothing at all about the physiological and pathological condition of the arrangements in the labyrinth that dampen sound. Whether the drumhead may originate a metallic accessory sound by resonance in the ear, or in the external auditory canal, for instance, when the membrana tympani is put on the stretch, I cannot decide.

I take the opportunity to communicate a case *where a small body touching the membrana tympani, caused a peculiar rattling after-sound.*

Mr. N., musician, complains that there is a peculiar additional sound in the left ear, accompanying all tones. He compares it to the ringing of a goblet or the rattling of a window pane when certain tones are sounded. When he plays the violin or the piano, for instance, he hears all tones clearly with both ears; but, in the left, with a different timbre, somewhat rattling, like the sound of a reed-instrument. As soon as the primary tone has died away, the secondary also vanishes. Although this phenomenon accompanies all tones, it is generally more expressed with one in particular, but it requires a certain intensity of sound to

* These ARCHIVES, vol. ix, p. 57.

produce it. The anomaly may often be suspended for hours. On making certain motions with his head, the patient feels as though something moved in his ear. Examination shows on the floor of the very dry auditory canal a few hard, yellow crumbs of dried cerumen, touching the (normal) drumhead. After removing these with the forceps (which caused a clear, crackling sound by pushing them against the membrana tympani) the phenomenon ceased and did not return.

4. Of further interest is the circumstance that the patient heard the tuning-fork half a tone higher if held before the left ear, which had been especially exposed to the concussion, this difference being, perhaps, the reason why all tones sounded false to her. I have already described a similar case in a young lady, where the symptom was caused by the explosion of a percussion-cap.*

The origin of this phenomenon may be referred to a change of pressure in the labyrinth, producing a different tension of the membrana basilaris, or in an increased tension of the membrana tympani. To distinguish between these two possibilities, the condition of the bone-conduction, as compared with the air-conduction, may be of service in some cases. If the cause of the elevation of tones is in the drumhead, the tuning-fork will sound higher when held before the ear, than when placed upon the skull; but if in the labyrinth, there is no reason why the two kinds of sound-conduction should cause a difference in tone.

The following observation by Oscar Wolf† may be compared herewith:

A complete closure of the left Eustachian tube with the characteristic retraction of the membrane had been caused by a musket-ball, which still lodged in the neighborhood of the tube. The left ear, healthy prior to the injury, showed for voice and watch a very considerable decrease of acuteness of hearing, the right ear being normal in all respects. "The tuning-fork C^0 and A^1 was heard normal with the right ear by bone- and air-conduction, but with the left much less plainly, and *distinctly one fifth higher.*

* *Monatsschrift für Ohrenheilkunde*, 1873, No. 4.

† These ARCHIVES, vol. ii, p. 2, p. 61.

The fork, on being placed upon the vertex, was heard with greater force on the left side, but its pitch was not raised." For particulars compare the original paper.

On the 64th day our patient also still heard the tones of the piano clearly by air-conduction with each ear separately, but false with both simultaneously. On taking a rod connected with the piano, between her teeth, tones and chords sounded clear, although much weaker on the left. If we wish to explain why the difference between the two ears ceased in bone-conduction, by an increase in the perception of the left side, we have much in our favor, but it is also to be borne in mind that by air-conduction one ear (in this case the right, the uninjured one) was considerably ahead of the other.*

5. Attention must also be called to the relation existing between osseous and aerial transmission. Politzer is right in laying great stress upon the presence of bone-conduction in making a prognosis in cases of traumatic ruptures of the drumhead. It harmonizes perfectly with the view which has been taken of the present case, concerning the bone-conduction, viz.: that the latter was almost entirely abolished during the first few weeks, and also later remained greatly inferior to the aerial transmission. If the cause of the deafness had been in the middle ear and not in the labyrinth, the bone-conduction would certainly have outbalanced the air-conduction; that is, the tuning-fork would have still been heard if placed upon the skull, when it could not have been heard before the ear.†

*I find, subsequently, that Hensen, in his new "Physiology of the Ear," supports the opinion of Lucæ and Helmholtz, according to which the bone-conduction (which he calls the cranio-tympanic conduction) takes the general course through the apparatus of the tympanic cavity to the labyrinth, and adds: whether a direct bone-conduction causes a perception of sound is yet unknown. This is an important point with otologists and ought to be thoroughly investigated. Guided by my observations made on patients, I cannot share the opinion of the learned physiologist, but believe the designation "bone-conduction" to be correct, and the whole process different from the general conduction. The observations communicated above strengthen my opinion, and I also find that with the bone-conduction the resonance, which was carefully avoided in transmitting sound in the general manner, plays an important part which seems to be quite plain under the supposition that the vibrations occur in the bone surrounding the cavities of the ear.

†Large tuning-forks with clasps (for instance, C^1) are best adapted to such examinations. Even when touched but slightly they sound a very long time and

It is well known that in the normal state the relation is just the reverse. Compare A. Fick in Schaumburg's Cyclus ("Anatomy and Physics of the Organs of Sense," p. 141): "Let a vibrating tuning-fork rest upon the front teeth, and when it has become inaudible, let it be held in the air close to the ear, instantly its sound is heard again."*

6. The fact which the patient relates of a little cerumen showing itself in the fourth week, is in keeping with the observation generally made that in affections of the middle or inner ear the secretion of cerumen is decreased or entirely stopped. Abnormal dryness of the skin of the auditory canal is quite a constant occurrence in chronic catarrh of the middle ear, especially the dry or sclerotic form.

7. As to the treatment of similar cases, I should advise a strictly antiphlogistic course in connection with rest, above all, rest of the diseased organ, and especially to avoid any irritating interference with the internal and external ears. Application of electricity has been tried in similar cases, from the supposition of paralysis of the acoustic nerve caused by over-irritation. I consider it injurious before all inflammatory symptoms have subsided. I would also call attention in the present case to the prejudicial influence of the camphorated oil prescribed by the family physician at the end of the second week.

---

without disturbing upper-tones. They are also to be preferred to the rod-shaped C-forks. They have the advantage of retaining their vibrations longer, and thus avoiding a frequent source of error.

*Hensen, in Hermann's "Manual of Physiology," vol. iii, 2, p. 26, asserts the very opposite, which I can only explain either by an oversight or by his having made experiments on abnormal ears.

SKIN-GRAFTING IN CHRONIC SUPPURATION OF THE MIDDLE EAR.

By EDWARD T. ELY, M. D., New York.

DURING the past two years I have made some experiments with skin-grafting in the treatment of chronic suppuration of the middle ear, and I wish to publish a brief account of my experience thus far. I believe that this use of skin-grafting originated with me, my first trial of it having been made in June, 1878. Since then I have operated upon nine cases, repeating the operation several times in some of them. In six of these the drumhead had been almost entirely destroyed, there was little or no discharge, and the mucous membrane of the tympanic cavity presented a more or less thickened and granular surface. Upon this surface were placed small pieces of skin taken from the forearm. In two cases, where a large part of the normal drumhead remained, the edges of the perforation were freshened by scraping, and a piece of skin laid over it. The dressing consisted of a borated cotton packing. The superficial layers of the cotton were removed within 24 hours, in order to inspect the deepest layer immediately over the grafts. This latter was not changed until it was found to be discolored by discharge. The packing was continued for several days, varying with circumstances. In one case the grafts were covered by a layer of goldbeater's skin before the cotton was applied. No advantage was seen from this. The instruments used were washed in carbolized water. The operation never caused pain or discomfort, but always excited a discharge. Sloughing of the grafts fol-

lowed within a few days in most instances. The benefit which I have observed to follow this treatment will appear from the following brief abstracts of some of my notes:

I. Female. Æt. 20. *Chronic suppuration both middle ears for 16 years.*

Nov. 21, 1879.—Three grafts placed in right ear.

Nov. 25th.—Two of the grafts are adherent and living.

Nov. 29th.—Grafts doing well.

Nov. 30th.—Discharge appeared, apparently caused by taking cold.

Dec. 3d.—Some sloughing at edges of grafts.

Dec. 9th.—Discharge has ceased under use of balsam of Peru. A portion of one graft remains and is growing.

The final result of treatment was the formation of a thin, cicatricial membrane over most of the suppurating surface. Before this result ensued, the grafting had been repeated several times and various medicinal applications had been made. The only point in the history upon which the writer would specially insist, is that two of the grafts certainly lived and grew. These pieces of skin were watched by Dr. D. B. St. John Roosa and by myself, and between Nov. 25th and Dec. 9th, we both saw new tissue shoot out from their edges. After this, the case did not progress so favorably, and much of what had been gained was lost again. All the subsequent grafts sloughed. It seemed to Dr. Roosa and myself that in this case and in one or two others, the operation had some effect in stimulating cicatrization, even though entire sloughing of the grafts appeared to occur. This beneficial effect is, of course, very doubtful, owing to the auxiliary treatment used.

II. Male. Æt. 23. *Chronic suppuration of left middle ear.*

Feb. 17, 1879.—One graft applied.

March 3d.—Part of the graft has lived and has been joined by offshoots from the edges of the surrounding tissue. The exposed surface has been reduced to about one-half of its former size.

In this case the operation was certainly successful, although complete healing was never attained. The new tissue formed by grafting still remains.

III. Female. Æt. 23. *Chronic suppuration of left middle ear for 2 years.*

Between Oct. 18 and Nov. 2, 1880, six grafts were inserted. The operation caused considerable mucoid discharge, and the grafts seemed to be washed away. Two very damp and "muggy" days seemed to affect the case unfavorably.

Nov. 8th.—No discharge. There are four whitish spots at the sites of four of the grafts and corresponding to them in shape.

Dec. 2d.—No discharge since Nov. 6th. The appearances of the ear are improved. The cicatricial spots remain and are extending a little.

The hearing was not altered in any of these cases.

The results reported above are certainly not brilliant, and yet I am encouraged, by what I have seen, to continue these experiments and to predict that skin-grafting will prove a useful addition to our means of treating chronic suppuration of the middle ear.

Two cases of myringoplasty have been recorded which were entirely successful. In these cases a piece of skin was laid over a perforation, the edges of which had been freshened. The operations were performed by Prof. Von Berthold, and an account of them may be found in the *Monatsschrift für Ohrenheilkunde*, November, 1878. To him belongs the credit of first calling the attention of the profession at large to this subject. His first operation seems to have been done August 1, 1878. An abstract of his paper, in English, may be found in the *American Journal of Otology*, vol. i, p. 306.

THE NITRATE-OF-SILVER TREATMENT OF ECZEMA OF THE EAR.

By H. KNAPP.

Acute eczema of the ear readily gets well, if the parts are kept clean, and exposure to cold wind is avoided; chronic eczema, however, is generally considered to be a very obstinate disease. In looking over the various text-books, and the paper by H. Auspitz in the *Archiv für Ohrenheilkunde*, i, p. 123, etc., 1864, a paper which has been extensively extracted and copied, we find the most varied forms of treatment recommended for it. It is not my intention to discuss the relative value of these different forms of treatment. I merely want to state that for many years I have employed nitrate of silver with greater satisfaction than I received from other remedies. We shall not be afraid of applying nitrate of silver to denuded places of the skin, if we only remember its excellent effect upon wounds from combustion. It does not affect the healthy skin, but contracts and hardens the softened and congested parts of it, and covers the denuded places with a transient thin pellicle or eschar, which, by its contraction, lessens their extent.

The cure of chronic eczema, if I am not mistaken, depends on two conditions:

1. Contraction of the softened and swollen integument.

2. Protection from moisture, wind and cold, also from great heat.

Nitrate of silver fulfils both these conditions better than

any other remedy, and as in its varying strength, from a weak solution to the pure lapis, it may be used in all degrees of intensity, from a mild astringent to a powerful caustic, it admirably adapts itself not only to all forms, but also to all phases of eczema. If, however, we want to be certain in its effect and cure our patients quickly, we must apply it with our own hands. I fully endorse the words with which Roosa concludes the description of eczema in his text-book, viz.: "We should carry out our own advice; never give over the treatment into the hands of the parents or attendants of the patient, for they will be incompetent assistants."

Apart from the cleansing, which the patients seldom do properly and efficiently, the physician has to suit the strength of the solution and the repetition of its application to the changing condition of the parts.

The *mode of treatment* of eczema which I have practised for years, is simply as follows: The whole external ear—auricle and canal—are gently but thoroughly cleansed. This is done by applications of warm water to which, if there be extensive excoriations, a very small quantity of an alkaline salt (chlorate of potash, borate or carbonate of soda, chloride of sodium) may be added. I have found no particular advantage in the cleansing with boracic, salicylic and carbolic acids, salicylate of soda, hypermanganate of potash, chlorine water, and the like, though they are certainly good, and I will not say a word against anybody who adheres to the one or other of these remedies by preference. When the scabs and crusts are soaked, they are easily removed with a fine sponge or a piece of linen. This should be carefully done, just as on the eyelids in blepharitis, for the remedy will not act on places where crusts are left. Under the scabs the secretion will continue, and while shut up it may decompose, and irritate the parts with which it comes in contact, thus prolonging the inflammation and rendering the treatment inefficient. After the careful removal of all crusts and other deposits, the skin should be gently dried with soft linen, and then the solution of nitrate of silver washed over it with a camel's hair brush.

A moist sponge is pressed on the skin immediately below the diseased parts in order to receive that portion of the solution which flows down. A two- or three-per-cent. solution (10 to 15 grs. to ℥ i aq.) is commonly strong enough; rarely have I used a stronger one, but frequently, especially when there is still a good deal of inflammatory irritation, and also at the end of the treatment, I have used a one-per-cent. solution. On the whole, it is advisable to begin with a one-per-cent. solution, and be guided by its effect. We shall find that only the sore places will be coated with eschars, which at first are white, then turn black. The softened skin around and between the excoriated places will be finely wrinkled and lined with a thin nitrate-of-silver pellicle. The parts should now be gently dried with linen or lint, and then covered with picked linen or lint to protect them from the atmospere. As long as secretion is present, the lint or picked linen which protects the parts may appropriately first be smeared with pure cold cream, or a one-per-cent. yellow mercurial ointment (hydrarg. oxid. flav. grms. 0.10, cold cream 10.00).

This application should at first be made every morning. If the secretion is still abundant, the ear should be cleansed again in the evening, as described above, and the dressing with greased lint renewed. The patient may do this himself.

If in this manner the ear is treated by the physician every morning, and cleansed by the patient every evening, we notice an improvement every day. The redness and swelling of the skin gradually lessen, the secretion becomes scanter and scanter, and the sore places dry up, at first being covered with scabs which the moistening with warm water does not remove, and which, when thrown off, leave a thin but healthy cutis. The nitrate-of-silver solution may be brushed over the diseased parts every day or at longer intervals, until the skin has lost its redness, lustre, and intumescence. In the latter stage tar (oleum rusci) may be used with advantage, but I find that it can be dispensed with, the cleansing, nitrate of silver, and protection as described, being sufficient to effect the cure from beginning to end.

The length of time requisite for the recovery varies with the condition of the diseased parts, and the habits, constitution and manageableness of the patient, but I think if the patient be under control, eczema of the ear always is. I am far from pretending that this disease cannot be cured in other ways, but I have tried the nitrate-of-silver treatment in comparison with other methods—application of salves, in particular empl. diachyli, and tar—on the same patient when both ears were equally affected, and found the nitrate the best. I will not forget to mention that it is recommended, among other methods, chiefly by Wilde, Voltolini, and Gruber.

In conclusion I beg to illustrate the above remarks by the clinical history of one case out of many.

The 16-year-old, healthy-looking daughter of Judge J. F. C. consulted me for eczema of both ears on September 29, 1880. She had suffered from it for two years. I found the mastoid and infra-aural regions, the posterior and anterior surfaces of the auricle, and the walls of the external meatus of both ears, red, swollen, covered with crusts, and painful to the touch. The caliber of the ear-canal was lessened by the swelling of the walls; there was a serous discharge from it, and the hearing somewhat impaired. The ears felt hot, and throbbed and ached at times.

I let her bathe both ears with warm water by means of a napkin for a quarter of an hour. Then I removed with a soft sponge all the scabs from the anterior and posterior surfaces of the auricles and the adjacent skin, whereas I cleansed the ear-canals with absorbent cotton, wound around a delicate dentist's cotton-holder. Immediately after that, I brushed a two-per-cent. solution of nitrate of silver over the whole extent of the diseased skin, and covered it with fine picked linen, held in position by a handkerchief.

The patient was directed to do nothing for her ear until the next morning. When then she came again, she told me that she had felt much more comfortable, and I found the ears less swollen and red. She bathed them again with warm water; the charpie which stuck to the sore places was gently removed; the ear cleansed and treated as the day before, only the charpie was smeared with yellow mercural ointment before it was applied to the skin.

This treatment was continued for six days, when all the sore places and the discharge had disappeared; the skin was less red; nitrate of silver was employed every other day in a one-per-cent. solution, and only where the skin was red. The patient was discharged cured on the tenth day, also her ear-canals and acuteness of hearing having become normal.

ABSTRACT OF AMERICAN OTOLOGICAL LITERATURE.*

FOR THE THIRD QUARTER OF 1880.

By Dr. SWAN M. BURNETT, of Washington.

1. Peculiar ear trouble. By Dr. Todd. *St. Louis Courier of Med.*, July.

The patient complained that every time he moved his head there was a crackling noise in the right ear. This noise was perceptible objectively over the sterno-cleido mastoideus muscle, even at the distance of a foot. There was a contraction of the velum palati concomitant with the contraction of the sterno-cleido mastoid. Patient of a nervous temperament, with a decided tendency to hypochondriasis.

2. A case of chronic suppurative inflammation of the middle ear, with acute inflammation supervening. Death from cerebral meningitis. By H. G. Cornwell. *Ohio Med. Recorder*, July.

No autopsy was obtained.

3. Acute otitis media suppurativa. By W. W. Seely, *Cin. Lancet and Clinic*, July 3.

In Dr. S.'s opinion purulency does not demand astringents and caustics. He relies on cleanliness, and boracic acid applied as a powder. He never uses a syringe for cleansing the ear, but employs absorbent cotton on a holder.

4. A comparison between the audiphone, dentaphone, etc., and the various forms of ear-trumpets for the deaf. By Laurence Turnbull, *Phila. Med. Times*, Aug. 28.

"In ten cases of deafness only one was decidedly improved in

* Authors of papers are requested to send one copy to Dr. H. Knapp, 25 W. 24th Street, New York, and another to Dr. Swan M. Burnett, 1215 I Street, Washington, D. C.

the acuteness of hearing by the audiphone ; two were not benefited by either apparatus, while six were greatly improved by the various forms of hearing-trumpet, and the one who could hear about as well with the one as with the other preferred using the hearing-trumpet." These conclusions coincide with those of Dr. Knapp, published in No. 1, p. 82, etc., vol. ix of these ARCHIVES.

5. A fatal case of acute suppurative otitis. By F. C. HOTZ, *Chicago Med. Jour. and Exam.*, August.

There was no autopsy, but from the symptoms H. concludes that death resulted from thrombosis and phlebitis of the lateral sinus (on one side—the left), and pyæmia. He also republishes a case from Trans. Ill. Med. Soc., 1876, of acute suppurative otitis, phlebitis and thrombosis of the lateral sinus, death from pyæmia, in which the results of the autopsy are given.

6. The cotton drumhead. By J. H. BUFFUM, *Trans. Amer. Homeopath. Oph. and Otol. Soc.*, 1880.

B. expresses a favor for the cotton drumhead in the majority of cases of perforation, and thinks that it is useful not only in improving the hearing power, but in assisting in the cure of the tympanal inflammation, and in preventing relapses. He prefers the dry treatment in cases of purulent otitis media.

REPORT ON THE PROGRESS OF OTOLOGY IN THE FIRST HALF OF THE YEAR 1880.

I.—NORMAL AND PATHOLOGICAL ANATOMY.

By Dr. H. STEINBRÜGGE, of Heidelberg.

Translated by R. C. Brandeis, M. D., of New York.

1. E. Zuckerkandl. The physiological and pathological anatomy of the nasal cavity and its pneumatic adnexæ. *Wien. Med. Jahrb.*, 1880, part ix, ii.

2. Wenzel Gruber, Professor of Anatomy, St. Petersburg. Anatomical notes. Virchow's *Archiv*, vol. lxxx, part i.

3. Hauerwaas. Contribution to the anatomy of the temporal bone. *Monatsschr. für Ohrenheilk.*, No. 5, 1880.

4. W. Kiesselbach, Erlangen. Contribution to the normal and pathological anatomy of the temporal bone, with special reference to the temporal bone of the child. *Arch. für Ohrenheilk.*, vol. xv, part iv.

5. Gellé. Studies on the structure of the external spiral ligament and its attachment to Corti's membrane. Société de Biologie, meeting of April 3, 1880. *Gazette Méd de Paris*, No. 19, 1880.

6. Gellé. Communication on the cochlea and acoustic nerve, based upon experiments on animals. Société de Biologie, meeting of April 17, 1880. *Gazette Méd de Paris*, No. 21, 1880.

7. E. Zuckerkandl. An unusual expansion of an osteophyte of the temporal bone. *Monatsschr. f. Ohrenheilk.*, No. 3, 1880.

8. E. Hofmann, Vienna. Aural hæmorrhage in a hanged person. *Wiener. Med. Presse*, 1880.

9. Lichtenstern. The symptomatology of thrombosis of the cavernous sinus. Report read before the Medical Society of

Cologne, October 15, 1879. *Deutsche Med. Wochenschr.*, No. 17, 1880.

10. JOHNSON. Case of septic infection of the lungs from necrosis of the petrous bone. *Medical Times and Gazette*, May 8, 1880.

11. HENRY THOMPSON, London. Clinical lecture on a case of otitis, with abscess of the cerebellum and pyæmia. *Medical Times and Gazette*, May 8, 1880.

12. JAMES ALLEN, Wandsworth Infirmary. Suppurative otitis, intracranial abscess, pyæmia, cerebro-spinal meningitis, death. *The Lancet*, May 15, 1880.

13. C. MIOT, Paris. Acute otitis media, complicated with tuberculosis of the lungs; rapid caries of the temporal bone; death; necropsy by M. Ball at the Hôpital Laennec. *Gazette des Hôpit.*, No. 67, 1880.

14. J. GOTTSTEIN, Breslau. Necrotic exfoliation of the entire temporal bone; favorable termination. *Arch. f. Ohrenheilk.*, vol. xvi, part i.

15. FIELD, London. A case of suppurative meningitis and abscess of the brain; remarks. *Lancet*, June 5, 1880.

16. P. MCBRIDE, Edinburgh. Contributions to the pathology of the internal ear. *Jour. of Anat. and Physiol.*, vol. xiv, part ii.

17. P. MCBRIDE, M.B., and ALEXANDER BRUCE, M.B. The pathology of a case of fatal ear disease. *Jour. of Anat. and Physiol.*, vol. xiv.

---

1. This valuable paper is so full of interesting matter, mainly of a statistico-anatomical nature, that we must limit ourselves to the mention of only the most salient points contained therein.

The author gives us, in 27 sections, the result of his researches into the variations in the development of the nasal and connecting cavities.

The height and breadth of the nasal cavities (section 3) are generally proportionate to the length and breadth of the facial skeleton; besides this, the breadth of the external nasal orifice is the most reliable determining factor for the width of the nasal cavity. The length of the inferior turbinated varies between 25–49 *mm.*; the middle varies considerably in size, especially at its anterior extremity, and often presents a different bulk in the

two nasal cavities. The upper turbinated, however, presents the greatest number of variations in size. Diffuse hyperostosis of the turbinated bones was observed by Zuckerkandl only twice. The communication of the middle nasal passage with the antrum of Highmore depends upon the formation of the processus uncinatus. This, in conjunction with one of the cells of the ethmoid, forms a groove which leads upward into the frontal sinus and downward into the antrum of Highmore. This the author calls the hiatus semilunaris.

Section iv treats of the deviations and foramina of the septum. Until the seventh year of life the position of the septum is perpendicular; later it often becomes asymmetrical. Sections vi–x contain reports on the fractures of the walls of the antrum of Highmore, their deficient development, senile atrophies, exposure of the cavity by caries of the alveolar processes, the development of osseous cysts, the formation of exostoses and endostoses of the anterior wall of the maxillary sinus. The examination of the skeleton is completed in sections xi and xii, which consist of notes on the ethmoidal and sphenoidal cells. The entire absence, as well as the abnormal development of both cavities, were noticed. Hyperostosis of the walls of the sphenoidal sinus did not invariably attend a similar condition of the other cranial bones, but, on the contrary, was only once observed.

As a result of syphilis, Zuckerkandl discovered deficiencies, perforations of the frontal sinuses, and also various osseous tumors in these cavities.

In section xiii we have the beginning of a report of 150 *post-mortem* examinations, as well as an analysis of the condition of the turbinated bones and the nasal passages. Four turbinated bones were found in 55 subjects (36.6 per cent.). The fourth turbinate is the consequence of a partition of the upper ethmoidal bone. Superficial grooves are rarely found in the spongy bones of adults, but in the new-born are quite common. Incurvations and incisions were found in 4 cases; synechiæ between the inferior turbinated and septum, in 2 cases; marked stenosis, owing to expansion of the middle turbinated bones, 4 times; and depressions in the outer nasal wall, 16 times.

In section xiv, the supernumerary opening into the antrum, which was found in fourteen per cent. of the specimens examined, is reported in detail. It is situated either above or below the processus uncinatus, and Zuckerkandl is disposed to call it foramen

naso-supramaxillare accessorium. Perforation of the septum was noticed in eight cases, insufficiencies or defects of the pneumatic adnexæ of the nasal cavity were noted five times (sections xvi and xvii).

In section xviii we find the results of catarrhal and inflammatory affections of the mucous membrane of the nasal and adjacent cavities. These were found in 39 cases (26 per cent.). The lower grades are characterized by an injection varying in intensity from a rose to a dark-red color, whereas, if the pathological condition is more marked, the mucous membrane is bathed in pus. Occasionally, abscesses are found in the mucous membrane. The adjacent cavities are also often affected, most frequently the maxillary antrum; then the sphenoidal cavity, and lastly, the frontal sinus, because it is more favorably situated than the others. The milder form of disease of the mucous membrane manifests itself in the adjacent cavities by a more or less intense swelling; the mucous membrane is thickened, œdematous; cysts are developed after the subsidence of the pathological process, and, occasionally, there is a collection of yellowish serum. In purulent inflammation the mucous membrane is not swollen. If the disease terminates favorably, the mucous membrane lining the nasal cavity will be the first to return to its normal condition. We now have a number of reports of post-mortems which go to illustrate the different combinations of the inflammations of the nasal cavity and its adnexæ. The author is not able to determine positively whether the occlusion of the channel of communication, by mere exclusion of air, without any preëxisting disease of the nasal mucous membrane, can give rise to a disease of the adjacent cavity.

Diphtheria of, as well as hæmorrhages into, the nasal and adjacent cavities, were severally noticed once. Section xxi describes cases of formation of polypi. These were found eighteen times (twelve per cent.), and of these, three were bilateral. Zuckerkandl differentiates three classes of tumors, *i.e.*, 1, tuberous, which may be flat, compressed, or have a fungoid appearance; 2, broad-sessile, grooved or lobulated; and 3, diffuse hypertrophy of a portion of the nasal mucous membrane. The majority appear to arise from the lips of the hiatus semilunaris and from the middle turbinated bone. Polypi were also found on the septum, in the sphenoidal cells, in the antrum of Highmore, each once. The hypertrophy of the mucous lining of the inferior turbinated

bone, found in 31 cases, is most common, as is generally known, on the posterior extremity. Mucous cysts were observed 31 times. Of these, 18 were in the antrum, 5 in the sphenoidal cavity, 3 in the pharyngeal tonsil, and 5 were in the nasal mucous membrane proper. Their contents were white; only that of Luschka's tonsil and a single one situate on the floor of the nose contained a honey-like fluid. The last section treats of the atrophy of the turbinated bones and their mucous lining. The spontaneous atrophy of the inferior turbinated bone is sometimes so great that it might almost be taken for a congenital defect. This atrophy, at times, also affects the middle turbinated bone, as well as the entire ethmoidal labyrinth. The cause of the general atrophy is obscure. Partial atrophy of the conchæ may be due to the pressure of tumors or to deviations and abnormal development of the septum.

2. Gruber describes: 1, a congenital foramen in the posterior wall of the external auditory meatus which opened into the cavity of the tympanum as well as into the mastoid cells. 2, a foramen, not congenital, posterior to the porus acustic. ext. This led into an enlarged mastoid antrum.

3. Hauerwaas describes the venous dilatations on the anterior extremity of the sigmoid sinus. Among 500 temporal bones subjected to examination he has found twelve times shallow or deep depressions of the anterior extremity of the sigmoid sulcus, which were to be considered as the initial stage of a coming perforation. In the fourteenth case the perforation had actually taken place.

4. Kiesselbach, in his paper entitled "The Anatomy of the Squamo-tympanic Bone," begins by describing the mastoideo-squamous suture to which L. Joseph and J. Gruber have already called attention. It is indicated by a line running downward from the incisura parietalis to the level of the lower wall of the auditory meatus, then turns forward and terminates in the incisura mastoidea. According to Schwartze and Eysell, this, in connection with the petro-squamous fissure, divides the mastoid antrum into a petrous and squamous portion. Kirchner has emphasized their clinical importance in relation to the propagation of inflammatory processes from the middle ear.

5. Gellé discourses on the stria vascularis, the prominence on the spiral ligament (ligamentum ascessorium, Waldeyer) and the sulcus spiralis externus. He describes the bow-shaped bundle of fibres composing the spiral ligament and surrounding

cavities in which cellular elements and globular conglomerations are contained. He also alludes to the fact that Todd and Bowman claimed to have found unstriped muscular fibres in the spiral ligament, whereas Kölliker (and most other histologists) deny this. In regard to the physiological import of these fasciculi, as well as that of the vascular loops in the stria vascularis, Gellé has not yet arrived at a satisfactory solution. As far as Corti's membrane is concerned, he is inclined to the belief that it is not suspended, but inserted into the spiral ligament. The specimens examined were taken from guinea-pigs, as well as their embryos. In the discussion which ensued, M. Duval mentioned that in order to preserve Reissner's membrane he has successfully employed collodion, and believes that it would also be of service in demonstrating the insertions of Corti's membrane.

6. GELLÉ also presented a report on some experiments which he had made on living guinea-pigs. After making a crucial incision in the membrana tympani he destroyed the cochlea, which in these animals is quite prominent; he also isolated it by means of a curved, tooth-pointed sound. The animals bore this operation very well, and failed to manifest those symptoms which are generally observed after a section or irritation of the semicircular canals. Thereupon, Gellé arrived at the conclusion, already reached by Flourens, that those fibres of the acoustic nerve which go to the cochlea, serve the function of hearing, and in their course and origin are entirely separable from the ampullar nerves. He alludes to Laborde's experiments, by means of which he had proven that after an injury of the inferior cerebellar peduncle (crus cerebelli ad pontem) the same symptoms had appeared as after lesions of the semicircular canals. He also spoke of Duval's investigations into the relation of the anterior root of the acoustic nerve with the motor ganglia and fibres of the cerebellar peduncle, already mentioned. According to these, the posterior root contains the acoustic fibres, those belonging to the cochlea exclusively, while the anterior only contains those destined for the ampullæ, or such nerve fibres as contribute to the maintenance of equilibration. Gellé thinks that this arrangement will serve to explain why, in apoplectic extravasations, which affect the posterior portion of the corona radiata of Reil, there should be unilateral deafness, but no interference with the maintenance of equilibrium. In the discussion which followed, Duval and Laborde confirmed Gellé's assertion, and the former added that the spiral ganglion in Rosen-

thal's canal might be considered as the trophic centre of the cochlear nerve. Its destruction must lead to an atrophy of the posterior peduncle, and the deductions drawn from the aforementioned experiments might be capable of further application. He also stated that experiments, heretofore made, have neglected to consider the termination of the nerves in the utricle and sacculus sufficiently. And, moreover, it is necessary to entertain the objection already raised (notably by Brunner), that an isolated destruction of merely a portion of the labyrinth, without lesion or secondary injury of the remaining parts, is almost impossible, owing to the diminutive size of the organs under consideration.

7. ZUCKERKANDL describes those temporal bones taken from the Viennese collection, which are noted for the unusual size of the osteophytes found on them. In the first, the outer surface as well as the cavities of the mastoid process, moreover the sigmoid fossa, as also the anterior wall of the external meatus, were covered with osteophytes, while the tympanic cavity was quite free from them. In the second specimen, a temporal bone taken from the right side, these formations also covered the outer wall as well as the cells of the mastoid process, the anterior wall of the external meatus, the upper surface of the petrous portion, and the sigmoid sulcus. Between this and the apertura aquæduct. vestibuli, there was a perforation about the size of a pea, which led into a cavity communicating with the jugular fossa.

8. HOFMANN, in consideration of the scarcity of well authenticated cases of aural hæmorrhage, occurring in persons who died from hanging, reports six cases. In two of them there was also a rupture of the membrana tympani, a coincidence which, as yet, has not been explained. The instance observed by the author occurred in a man aged 68 years, in whom a hæmorrhage was found from both ears. At the *post-mortem*, there were seen numerous punctiform ecchymoses on the scalp as well as in the conjunctiva, and also injection of the tympanic mucous membrane. The membranæ tympanorum were uninjured, but the mallear arteries were congested, the epidermis of the posterior-upper auditory wall detached by fluid blood and ruptured in places in the neighborhood of the tympanic membrane, so that the extravasation had evidently been caused by the intense congestion. The author emphasizes the abundant vascular supply in this region, and also refers to the frequency of hyperæmia, even after an ordinary specular examination and other simple mechanical inter-

ferences. Conditions favorable for such sanguineous extravasations are present also in asphyxia.

9. LICHTENSTERN: a petrous bone, in a boy aged 14 years, destroyed by caries. The disease had given rise to phlebitis and thrombosis of the transverse sinus, with a projection of the thrombus into the internal jugular vein, as far as the entrance of the facial vein; also into the superior petrosal sinus, the cavernous sinus and the ophthalmic vein. The diagnosis was made during life, owing to the œdema of the left side of the face, as well as the left exophthalmus with chemosis and increased conjunctival secretion. The patient states that for several years he had been deaf, had suffered pain, but noticed no discharge from the ear. For a week past there were vertigo, headache, and fever,—no chills. Besides these, there was œdema of the left aural region, which was accompanied by a partial closure of the auditory meatus, a stiffness of the neck, great restlessness, intense atypic fever. Death ensued on the day of his reception to the hospital. In the discussion which followed L.'s communication, it was stated that thrombosis of the cavernous sinus did not necessitate exophthalmus or choked disk.

10. JOHNSON reports the case of a boy aged 14 years, who, for only six weeks past, had been affected with a slight discharge from the right ear. On March 20, 1880, he began to complain of chilliness, headache and thoracic pains. Three days later there was unsteady gait, continuous headache, temperature 95.4° F., coated tongue, constipation, night sweats. He only returned for treatment on April 7th, when he was admitted to the hospital. Temperature 101° F.; pulse 138; pupils regularly dilated; 60 short respirations per minute; dulness and crepitation over the chest. On the day following, delirium set in; involuntary defecation. The delirium continued the day after. Coma. Death.

Post-mortem.—Double pleurisy; conical infarcts in both lungs; bronchitis. Pus in the right internal jugular vein. A small abscess at the apex of the petrous bone, beneath the dura mater. Coagulum of blood in the posterior half of the sigmoid sinus, but no pus. Necrosis of the petrous bone near the labyrinth. Thick pus in the tympanic cavity. Brain normal, with the exception of dilatation of the lateral ventricle by abundant fluid. The aural discharge was also very slight during the patient's stay in the hospital.

11. THOMPSON reports the case of a girl of 12, of a phthisical

family, who was received in the hospital on October 12, 1878. For six years there had been a fœtid discharge from the right ear. For several years past patient had suffered from headache, and within the last six months had considerably fallen off in weight. On October 9th she had vertigo and vomited. On reception there were found: hectic flush on cheeks; equally dilated pupils; temperature 100; pulse 112, small, easily compressible; respiration 28; uninterrupted vomiting; frontal headache. Later, repeated chills (thirteen times in eighteen days). The headache shifted from the frontal to the occipital region; scalp swollen; dysphagia; involuntary defecation; distressing cough; thoracic pains. October 25th, dulness and creptiant râles on both sides. October 30th, coma; died in convulsions. Pulse not less than 100, and as frequent as 163. Greatest number of respirations, 76, sometimes paroxysmal, but no Cheyne-Stokes rhythm. Highest temperature was 105.2°; least 99.4°. At the *post-mortem* there were found: hyperæmia of pia mater; right hemisphere of cerebellum, above and without, adherent to the slate-colored dura mater, very friable, and, on rupture, yellowish green pus is evacuated from an abscess the size of a walnut. In the left corpus striatum, a small tuberculous deposit, extending into the lateral ventricle, was found. On the right half of the posterior occipital fossa, the dura-mater was found thickened, discolored and partly detached from the bone by a collection of pus. The anterior half of the right sigmoid sinus was converted into a narrow canal filled with pus. The right internal jugular vein contained a gray adherent thrombus, bathed in pus, and reaching to the subclavian vein. From here a non-adherent coagulum extended through the vena cava superior into the right auricle. Pleuritic exudation into the right pulmonary cavity; pseudo-membranes on the pleura; pyæmic abscess in the anterior inferior lobe of the right lung; besides these, numerous purulent foci in both lungs. Temporal bone: lining of the external meatus thickened and discolored; membrana tympani has a small perforation at its lower margin; tympanic cavity, vestibule and semicircular canals filled with a creamy pus.

12. James Allen reports the case of a girl, aged 19 years, who had suffered since infancy from aural discharge and deafness. She was of a phthisical family, and since her fourth year was subject to convulsions. On December 19, 1879, she began to complain of pain in both ears, which soon extended over the

whole head. She vomited and was unable to keep the head erect. At the end of the month she became paraplegic, and was seized with pain in the right side of the chest. On January 6, 1880, she was received to the hospital. Motor paralysis of the lower limbs, great pain on least touch of the scalp or spine. Before death, which occurred on January 10th, the temperature was 98; pulse 160. The autopsy revealed an abscess beneath the dura mater on the anterior surface of the right petrous bone. Membrana tympani and the ossicula auditûs were destroyed; pus in the tympanic cavity, the mastoid cells, as well as in the labyrinth. Intracranial abscess above the tegmen tympani. The spinal cord at the lower half of the cervical and upper half of the dorsal regions, was softened and adherent to the envelope. Congestion of the pia mater. Right lower lobe of lung hepatized, a capsulated empyema at its base, communicating with a small abscess in the lung. On the left side, low degree of pleuritis; base of lung œdematous, congested, showing several superficial infarctus in varying stages of purulency.

13. Miot describes the case of a man, aged 35, who, on February 14, 1879, was admitted to the Hôpital Laennec on account of tuberculosis. Three months before, a purulent inflammation of the middle ear began; since then, continuous otorrhœa. Since Janury 27th, there was right facial paralysis. Movements of the lower jaw somewhat impeded and painful. Pressure on the mastoid process caused uneasiness. After repeated microscopic examinations of the discharge, particles of bone were discovered. On March 22d a pretty large loss of tissue of the anterior bony wall of the external meatus was discovered, allowing a probe to reach the maxillary articulation. Death ensued on April 8th in consequence of the pulmonary affection.

Post-mortem.—Soft parts of the right maxillary articulation thickened, as was the adjoining periosteum. Tympanic cavity filled with pus; osiculas, with the exception of the stapes, destroyed; caries of the anterior part, the inner wall, and the roof of the drum cavity; the dura mater covering it red, thickened, softened. That portion of the facial nerve within the horizontal part of the Fallopian canal, as well as the chorda tympani, destroyed. Mastoid cells filled with pus, and converted into a large cavity. The reviewer calls attention to the importance of examining the pus for the determination of a carious process. He has observed that, even in advanced stages, purulent otitis in

tuberculous patients may be cured, or at least improved, and that it does not so frequently give rise to carious affections of bone as is generally supposed.

14. GOTTSTEIN describes a case in which a sequestrum was removed which involved the entire mastoid bone, the sigmoid sulcus, the walls of the bony portion of the Eustachian tube, a portion of the squamous bone and also the anterior and posterior walls of the petrous bone, including the cochlea and semicircular canals. A girl, aged 1½ years, suffering since her sixth month from otorrhœa and facial paralysis on the right side, had repeated abscesses in the mastoid region.

On August 26, 1879, she was placed under Gottstein's care, who enlarged the opening of an abscess, and readily removed the sequestrum. The abscess cavity closed readily, the discharge ceased, and the child recovered entirely, with the exception of deafness on the right side and paralysis of the corresponding facial muscles. Two months later, hard bone was again felt in the mastoid region. The most interesting point in the very detailed report was the fact that the upper surface of the roof of the tympanum was quite smooth and not affected by the caries. The petro-squamous suture, as well as a portion of the squamous bone, was intact; the necrosis had, at this point, passed over the suture, and ceased at the junction of the mastoid bone with the occipital. The fact that the sigmoid sinus, in spite of the destruction of the sulcus, had remained intact, and that in spite of the great loss of bone tissue no meningitis ensued, is due, according to the author, to the fact that a new growth of bone formed on the periosteum, which, probably, afforded protection to the soft parts before the exfoliation of the necrosed portion occurred.

15. FIELD's case was that of a gardener who came under observation on January 24, 1880. For sixteen years he had suffered from discharges from the right ear, the sequel of scarlet fever. He had intense headache. Eight leeches ordered and iodide of potassium. The ear was syringed with a weak solution of carbolic acid. Three days later, death occurred suddenly. *Post-mortem:* Purulent meningitis above the right petrous bone, as well as above the tentorium cerebelli and posterior occipital fossa. The inner surface of the petrous portion of the sigmoid sinus changed to a dark gray color. The bone was so soft that it could easily be bored into. In this region there was a consistent, partly

blackened, partly yellowish-brown thrombus. Dense layers of purulent coagula were found on the inferior surface of the temporal lobe and on the inner surface of the occipital lobe. In the right hemisphere of the cerebellum, externally to the corpus dentatum, an abscess was found the size of a walnut, with dirty-gray purulent contents. Brain substance and meninges generally congested ; ventricular fluid increased in quantity. Petrous bone : pus in external meatus, membrana tympani destroyed, mastoid cells converted into an irregular cavity and filled with pus. Adjacent bone congested and softened. Tympanic cavity filled with yellow, cheesy substance, which also obstructs the tympanic orifice of the tube. Anvil and stapes not to be found ; the malleus lay in the tympanic cavity, its head being carious. Only the origin of the chorda tympani was preserved. In the vestibule there were soft, cheesy masses which, on microscopical examination, were found to be composed of fat globules and flattened epitheloid cells. Cochlea, semicircular canals, Fallopian canal and facial nerve unchanged. The author also describes the origin of cerebral abscesses in general.

16. McBride reports the examination of two labyrinths. In the first case there was a round-cell sarcoma of the cerebellum, which extended to the floor of the right internal auditory meatus and into a part of the bony wall of the cochlea. The patient, when received to the hospital, was deaf and was also affected with a right facial paralysis. The deafness had existed for a year, the facial paralysis for six months. In the scala vestibuli of the cochlea, there was found a coagulum occupying three fourths of the lumen and the orifices of the modiolus. It was composed of a tangle of delicate, transparent fibres, and also contained in its network numerous lymphoid cells. The author believes this to be a croupous exudation, and attributes the deafness to a croupous inflammation and not to pressure of the tumor upon the nerve trunk, as the paralysis set in so much later. The periosteum of the cochlear convolutions, as well as Reissner's membrane, was thickened. The vessels of the bony and soft structures were dilated. The cochlear wall showed an infiltration of small, round cells, similar to those found in the sarcomatous tumor. Corti's organ was normal in appearance, nor was there any croupous exudation in the vestibule or in the semicircular canals. The second specimen was the right labyrinth of a patient who died of acute rheumatism, and who, while taking salicylic

acid, had become deaf. A bony semicircular canal, on section, revealed an angular contour instead of a rounded one, and the membranous canal contained in it was not in contact with the periosteum, but was surrounded with connective tissue. McBride considers this metamorphosed myxomatous tissue dating from the fœtal condition.

17. McBride and Bruce showed two specimens taken from a patient who, for years, had suffered from a purulent discharge and marked deafness of the right ear. Perforation of the drum membrane, retention of inspissated pus; left ear normal. Three days before death the tuning-fork, when placed on the forehead, was heard more distinctly in the right ear, which justified the opinion that the nervous apparatus was still acting. Clinical history not given. The reporters saw the patient only once. At the *post-mortem*, the tympanic cavity and the mastoid antrum were found filled with a yellowish, white, creamy substance, which was composed of pus corpuscles, oil globules, numerous cholesterine crystals, epidermal cells and rod-like bacteria. Tympanic mucous membrane thickened by hypertrophy of the connective-tissue layer, which diminished the size of the cavity. The intrinsic muscles of the ear, as well as the ossicula, with the exception of the stapes, had disappeared. External meatus narrowed. Mastoid process converted into solid bone tissue. A white mass, composed of pus corpuscles and fat, was found in the vestibule. The cochlea appeared to be destroyed, only detritus and a few pus corpuscles remained. The osseous structure in the neighborhood of the semicircular canals was permeated with rod-like bacteria. These were found between the lamellæ and also in the perivascular lymph-spaces, in the adventitia of the arteries, within the bony semicircular canals, as well as between the fibres of the facial nerve. The veins contained plugs which also consisted of bacteria. McBride concludes from the tuning-fork test that the entry of the bacteria into the labyrinth took place only within a very few days before death, and by the way of the vascular communications between the tympanic mucous membrane and the labyrinth. Moreover, he agrees with Binswanger, that cerebral abscesses resulting from disease of the temporal bone, and separated from the diseased spot by a mass of healthy brain substance, arise in the following manner: infectious micro-organisms pass into the circulatory system from the purulent points, or are transported along the connective tissue which envelopes the vessels.

Bruce describes the abscess complicating this case, and situated in the outer half of the right cerebral hemisphere. It was adherent to the posterior petrosal surface in the vicinity of the internal auditory meatus. Dura mater detached here; trunk of the acoustic nerve intact. The abscess was about the size of a walnut, consisted of greenish viscid pus, contained the same rod-like bacteria as found in the petrous bone, and glistening, round, granular bodies, which Bruce looks upon as bacteria. Numerous punctiform hæmorrhages were also found in the neighborhood. A few vessels contained thrombi, and pus corpuscles were in the surrounding lymph sheaths; some also contained the above-mentioned glistening granules. In one specimen only were any bacteria found. Bruce believes that here, also, the transmission of the disease was brought about by the perivascular lymph sheaths. There was thrombosis of the veins, and hence, collateral increase of pressure and hæmorrhage, both of which superinduced the formation of pus. As a more general examination of the body was not allowed, it was impossible to determine whether or not any other pyæmic deposits existed.

II.—PHYSIOLOGY OF THE EAR AND PHYSIOLOGICAL ACOUSTICS.

1. P. GRÜTZNER, of Breslau. Physiology of voice and speech. L. Hermann's *Hand-book of Physiology*, vol. i, part 2. Vogel, Leipzig, 1879.

2. V. HENSEN, Kiel. Physiology of hearing. *Ibidem*, vol. iii, part 2. Leipzig, 1880.

3. FRIEDRICH BEZOLD, Munich. Experimental investigations on the conductive apparatus of the human ear. *Arch. f. Ohrenheilkde.*, vol. xvi, parts 1 and 2.

4. OSCAR WOLF. Frankfort on-the-Main. The functions of the chorda tympani. These ARCHIVES, vol. ix, p. 293.

5. A. E. DOLBEAR, College Hill, Mass. On the number of vibrations necessary for the recognition of pitch. *American Journal of Otology*, vol. ii, January 1, 1880.

6. CLARENCE J. BLAKE, Boston. Edison's resonant tuning-fork. *Ibidem.*

7. C. SPAMER, Giessen. Experimental and critical contributions to the physiology of the semicircular canals. *Arch. für die gesammte Physiologie*, vol. xxi, Nos. 10–12.

8. M. DUVAL, Paris. The physiology of the semicircular canals. Société de Biologie, Séance de Fevrier, 1880. *Gazette des Hôpitaux*, No. 27.

9. L, LANDOIS. On sounding vocal flames. *Centralblatt für d. medic. Wissenschaften*, 1880, No. 18. Preliminary communication.

---

1. GRÜTZNER in the first chapter of the physiology of the voice speaks of reed instruments.

The next chapter treats of the anatomy of the "voice-forming apparatus," that is, the larynx, the pulmonary apparatus and the wind-pipe; as well as of the physiology of their movements, and is illustrated with most excellent wood-cuts.

Under the heading "On the Formation of the Voice in the Living Subject," we find an historical synopsis, beginning with Hippocrates and extending to Manuel Garcia, the inventor of the laryngoscope, and those investigators who have done most to popularize this instrument and laryngology, namely Türck and Czermak.

2. HENSEN'S work is destined to fill the void which the "theory of tone-perception" advanced by Helmholtz with creative force, has left between it and a series of occasional papers on the "physiology of audition." The "introduction" is intended to convey to the reader an appreciation of the most important laws governing physiological acoustics, in a concise and intelligible form. For this the author presupposes a thorough mathematico-physical knowledge of the theory of sound. This is, of course, possessed by every professed physicist, but it would have been desirable if these principles had been treated of more in detail for the benefit of other readers. The theories of tone, of the combination of vibrations, of partial tones, of combination sounds, of noises and beats, are treated of in a manner coinciding with the views of Hallström and Helmholtz (Perception of Sounds, 4th edition) in a space of less than 16 pages.

The author has followed the subsequent divisions in elucidating the anatomico-physiological outlines of the function of hearing: 1. The sound-receiving and transmitting apparatus, consisting of the external and middle ears. 2. The labyrinth, which analyses the sound-waves and converts them into nervous excitation. 3. The percipient apparatus, the acoustic nerve, and its cerebral expansion.

CHAPTER I.—THE FUNCTION OF THE EXTERNAL AND MIDDLE EARS.

After a comparative anatomical survey, in which the rationale of the differences in the conducting apparatus in the amphibiæ, on the one hand, and animals living in the air, on the other hand, are briefly narrated, the author describes the functions of the auricle. He reviews the experiments of Mach, Schneider and Rinne, and deduces therefrom the conclusion "that the auricle has some, but a very slight, influence on the acuteness of hearing and the perception of sound."

The construction and the acoustic importance of the component parts of the auricle, more especially of the space between the concha and tragus, have not been considered. Nor has he alluded to Politzer's explanation "that the auricle, by reflexion of the sound-waves into the external meatus, contributes materially to intensifying the sensation of sound."

In reference to the function of the external meatus, attention is paid to the distribution of the branches of the pneumogastric nerve, irritation of which gives rise to tickling and nausea, and if persisted in, may even cause vomiting.

No allusion is made to the "ear cough," which often ensues after irritation of the external meatus. Hensen says that it is not known why no cerumen is deposited upon the membrana tympani. The reviewer believes that the reason for this may be found in the fact that there are no ceruminous glands situated in the vicinity of the drum-head.

Under the heading of "Cranio-tympanal conduction," the doctrine of the conduction of sound by means of the bones of the cranium is formulated as follows: "That this undoubtedly, to a great extent, passes through the apparatus of the tympanum to the labyrinth. To what degree a direct bone-conduction may excite a perception of sound, is not yet determined."

The quotation of Rinne's view on the transmission of sound by the cranial bones (*Prager Vierteljahrschr. f. pract. Heilk.*, 1 pag. 71, 1855) requires a correction. Rinne found that the transmission of sound by the cranial bones is much less intense than that transmitted by atmospheric air, and that by means of the following experiment: "If a vibrating tuning-fork is placed upon the upper incisors, and kept in this position until the vibrations have died away, the sound will be heard anew and with increased intensity when the tuning-fork is held close to the ear."

Hensen, however, quotes Rinne as follows: "If (pag. 26) a vibrating tuning-fork, which is held pretty close to the ear, is no longer heard, the tone will again be recognized when the handle is placed upon the teeth; if now the vibrations cannot be distinguished, they can be heard anew when the external meatus of one of the ears is stopped up."

FUNCTIONS OF THE MIDDLE EAR.

We come now to the consideration of the anatomical construction of the membrana tympani and the ossicles of the middle ear; then to the physiological importance of the various ligaments, which limit the movements of the chain of ossicles and prevent their excursions from becoming too great.

Next comes the consideration of the physiological importance of the ratchets of the malleo-incudal joint, in which the author agrees with Helmholtz's views (Pflüger's *Archiv*, vol. i, part 1). The mechanism of the movements of the chain of bones is illustrated by fitting cuts, and here we must emphasize the opinion advanced by Henke that the body of the stapes not only performs a to-and-fro motion, but also revolves, partially, on its axis.

The most important factors of the functions of the drum-head and of the chain of bones are summarized as follows: "It is the mechanical object of this apparatus to convert the air molecules which reach the drum-membrane, and possess great amplitude but slight force, into a vibration of small amplitude but increased force, and to transmit with as little loss as possible these movements directly to the labyrinthine fluid."

In order to facilitate the understanding of the movements of the membrana tympani, we next have an analysis of the "mechanism of sympathetic vibrations," which also plays a very important part in the function of the labyrinth.

In reference to the cause of the uniformity of our perceptions of sound, Hensen adheres to the views of Mach and Seebeck, according to which the proper sound of the drum-membrane is a comparatively deep one (not over 700 vibrations), which, even by a moderate damping of the membrana tympani such as is caused by the ossicles, ligaments and labyrinthine fluid, may be sufficiently eliminated so as not to exert a disturbing influence.

We next have "direct observations on the vibrations of the ossicular apparatus." After summarizing the experiments of Politzer,

Mach, Kessel, Graham Bell, Blake, Buck and himself, Hensen arrives at the conclusion already reached by the reviewer in 1870 ("Speech and Hearing," pages 213 and 214). "Nearly all of these experiments, elaborate and valuable as they are, can only be regarded as initiatory steps to the elucidation of normal processes, for in every case they treat of sounds of excessive intensity, of diseased organs or of a malposition of the membrana tympani, of exposed tympanic cavities or labyrinths, or the influence of abnormal conditions affecting resonance, and, occasionally, of dead-weights, which give rise to independent sounds. Taken all in all, however, the results of the physiological investigations are in harmony with the physical and anatomical postulates."

The vital point of the theory of the transmission of sound by the ossicula auditûs; whether this is done by a united movement of the chain (Ed. Weber, Helmholtz, and Politzer) or by molecular vibrations within it (John Müller, Riemann, and most comparative anatomists) is but superficially treated by Hensen, who declares himself in favor of the first-mentioned theory.

In the following chapter "On the impediments of motion of the membrana tympani," the author says: "Whereas, contact or loading has a very disturbing effect upon a free-sounding membrane, this is less the case with a membrane like our drum-head, the damping of which has an influence on sympathetic vibrations only. It is well known that touching the membrana tympani with a probe, or depositing foreign bodies upon it, does not materially interfere with the perception of sound.

In the chapter, "Tympanum and Eustachian tube," the functions of the tube are mainly considered. We miss, however, the consideration of the physiological or acoustic importance of the mastoid cells; and the theory of the vascular supply of the drum-membrane, so important in a pathological and therapeutic sense, is not touched upon, nor is anything said of the innervation of the tympanic cavity.

The function of the "inactive tube" consists mainly in its power, owing to the ciliated epithelial lining which is directed toward the pharynx, to serve as an outlet for any accumulated secretions in the tympanic cavity; during the state of rest it may be considered as partially closed.

The conclusions arrived at by Arthur Hartmann, after experimenting with compressed air, are accepted and summarized as follows: By these experiments it is settled that the tube is neither

firmly closed nor widely dilated. If its normal condition is to be determined more positively, we may say that a slight closure is more common than ever so slight a patency. In the cetaceæ the tube is open.

As for "the movements of the Eustachian tube," Hensen says that noteworthy changes of the external atmospheric pressure manifest themselves very slowly in respect to the air contained in the tympanic cavity; it will suffice if the tube is opened from time to time. The conditions and the mechanism of this dilatation of the tube have been carefully investigated by aurists. Air passes most freely into the tympanum during deglutition; according to Hartmann a minimum of 30 *mm.* hydraulic pressure is necessary thereto. Politzer states that in swallowing we first have a positive and then a negative pressure in the tympanic cavity.

TENSOR TYMPANI AND STAPEDIUS.

As these have transverse muscular fibres, very rapid movements may be attributed to them. The tensor draws the drum-membrane inward, but without causing any considerable excursion of the malleus upon its transverse axis; but even in the passive state it exercises a certain tension upon the entire apparatus of the drum-membrane and its ligaments, by virtue of its intrinsic elasticity, and thus prevents any flabbiness of the parts under consideration.

The stapedius regulates the movements of the body of the stapes so that it moves forward into the cavity of the tympanum with its anterior periphery, and with its posterior periphery into the labyrinth; at the same time the circular membrane becomes more tense.

It acts as an antagonist of the tensor (Politzer). Nearly all investigators who have examined the movements of the ossicula auditûs have affirmed the influence of the muscles.

Hensen now quotes his experiments* upon living cats and dogs, and discusses the views on accommodation, but arrives at the conclusion that, so far, no definitive proof of the action of the muscles during the act of hearing has yet been given. Tension of the tensor tympani dampens the higher tones much less than the lower ones. The tensor appears to be set in motion by reflex action in consequence of a vibration of the membrana tympani, but not by a continuance of its movements. But it must be remembered that

* See report in these ARCHIVES, vol. viii, part 2.

the contractions of the tensor continue even after division of its tendon; we see, therefore, that they are not induced by succussion of the drum-membrane as the tendon reflexes are. So far it has not been found that tension of the ligament of the stapedius has any influence upon the movements of the chain of bones.

SECOND CHAPTER: FUNCTIONS OF THE LABYRINTH.

We now have a résumé of the anatomical condition of the organ under consideration. Owing to the connection of the aquæduct of the cochlea with the subarachnoid space, all pressure in the labyrinth can be distributed to the subarachnoid space. The function of the membrane of the round window is now stated, and its dependence upon the movements of the chain of bones demonstrated; John Müller's opinion, that this membrane is able to transmit sound directly to the cochlea, is disproved; only in case the chain of bones is interrupted is it possible to conceive how a transmission of sound can take place from the round window.

The membrana basilaris presents some features of unusual interest because it must be considered as a primary factor in the sympathetic vibrations. It increases in size from the root of the canal in the proportion of 1 to 12 (0.041 *mm.* to 0.495 *mm.* in the helicotrema), while the strings of a piano-forte increase in the proportion of 1 to 30.

Hensen's opinion of the functions of the labyrinth may be stated as follows: "The result of these investigations is that, at any rate, a series of nervous attachments must be sought for which, provided with a dampening apparatus, *are attuned to* the series of tones which we perceive. Near this there is probably another apparatus which promotes the perception of impulses and wave-movements."

If this apparatus is to be sought for, then comparative morphology must assert itself, because it is to be expected that it will present these organs in all their stages of development in their simplest forms. Hensen now begins the description of the "otholith sacs." From this we learn that the otholith sac of the lobster contains about 468 terminal nerve filaments, which follow each other in direct succession. As to their size, we here find a difference of volume in the proportion of 1:140. Compared with the dimensions of organ pipes this series would embrace three octaves. Besides the otholiths, there are found on the surface of the bodies of crabs and lobsters certain freely projecting appendages

of the nerves, which may be looked upon as auditory hairs of the acoustic nerve. Passing over to the comparative analysis of the cochlea, Hensen again agrees with Helmholtz, who seeks in this apparatus the organ possessing the power of analyzing sound; because it cannot be doubted that the analysis of sound is of the greatest moment in hearing, and as we employ it so freely it must require a very elaborate apparatus. The most complicated and highly developed apparatus, as well as that which last reaches perfection, is the cochlea.

THE THIRD CHAPTER IS DEVOTED TO THE ACHIEVEMENTS OF THE AUDITORY APPARATUS AS FAR AS ITS PRIMARY GANGLIONIC REGIONS.

As for the limits of the perception of sound, it has already been stated that Hensen considers the lowest tone one of 20 vibrations per second, the highest limit being one of 40.460 (double) vibrations (in the 8-marked octave). But Hensen does not believe that the highest limit has yet been reached; he does not think that these tones can be intense enough to set the comparatively rigid human drum-membrane into vibration.

The opinion coincides with those advanced by Blake and Turnbull* upon the upper limits of the perception of sound (Reviewer).

In his "sensibility for differences in pitch," Hensen has given the number of Corti's fibres as 16,400; he is furthermore of the opinion that no less than a difference of $\frac{1}{3}$ vibration can be distinguished, and this only in the range from a^1 to c^2; above and below these the power of discrimination diminishes; above c^5 errors of 100 to 1000 vibrations may occur.

In "the determination of the individual range of hearing," Hensen also, among others, alludes to Politzer's acoumeter. He also approves of the use of the voice in examining the degree of hearing and expects good results from the electrical apparatus recommended by Hartman, Preyer and Hughes.

"Apparatuses for increasing the intensity of hearing."

Ear-trumpets are not approved, because if they are very large, they produce standing waves, and, as the resonators do, they only increase certain tones; this increase of intensity is of no service in hearing the voice. Nor does the author expect any great benefit from the microphone.

*See these ARCHIVES, vol. ii, part 1.

"Endotic perception of sounds" is divided into two groups. Subjective noises are so easily produced in absolutely healthy ears, that they may be almost classed as physiological phenomena, especially deep, subdued sounds, or high ringing. Hensen classes in the first group that which Helmholtz designates as the deep resonance tone (c^{-1}), but he considers it as a muscular noise; also the pulsating noises of the larger vessels. The seat of the "high ringing," is not yet determined, and, therefore, it cannot be accurately classified.

The "hallucinations of hearing" are only cursorily touched upon, not more than four lines being devoted to them.

He says of "galvanic irritation," that "the ear is not favorably located for the application of galvanic excitations; a few secondary currents only can reach the terminal apparatus or the acoustic nerve, and we never know what is really excited."

Experiments to lay down fixed laws by which the reaction in the healthy or diseased ear can be determined, have often been made, but do not appear to have afforded any satisfactory results.

3. Bezold examined, on fresh temporal bones, the exposed plate of the stapes, as seen from the labyrinth, and found (as had already Weber-Liel) that, on moving the handle of the malleus outward, the excursion of the plate was much more considerable than on moving it inward. During exhaustion of air the membrana tympani was also found to move outward much farther than it moved inward, when the air in the auditory meatus was condensed by compression.

Division of the tendon of the tensor tympani moderately increases the mobility of the entire apparatus, and the tensor is found to afford considerable protection to the membrana tympani, the incudo-stapedial joint and the annular ligament.

Division of the stapedial muscle also increases to a certain degree the movements of the labyrinth manometer, both upward and downward. The action of this muscle upon the stapes, which was principally observed with the aid of the manometer on the exposed oval foramen, consists in diminishing the excursions and incursions of the foot-piece of the stapes at least one-half, inasmuch as it maintains the medial fixation of the posterior and inferior portions of the foot-piece. This was demonstrated by means of pressure exerted with a needle.

Variations of atmospheric pressure, which are directly produced

in the cavities of the middle ear, give rise to a maximum movement in the labyrinth manometer of 15.28 (= .5 *mm.*), of which equal parts are to be set down to the positive and negative side.

After division of the stapedio-incudal joint the movement is increased to 20.20.

The mobility of the membrana tympani secundaria in the exposed fenestra rotunda, as determined by means of the manometer, equaled 14.60, of which 8.00 must be credited to the incursion and 6.60 to the excursion. We may conclude therefrom that the movements of the labyrinth manometer in this case are due to the incursions and excursions of the membrane of the fenestra rotunda, while the atmospheric pressure exerted upon the membrana tympani and the foramen ovale, respectively, neutralizes each other.

A similar investigation of the movements of the foot-piece of the stapes on the exposed oval window, the tendon of the stapedius being intact, showed a maximum movement of 3.81, of which 1.96 was upward and 1.85 downward. Thus it is found that the foot-piece of the stapes when isolated has an average mobility of almost $\frac{1}{16}$ *mm.*

Division of the tendon of the stapedius increases the movements to about $\frac{1}{8}$ *mm.*

The author inclines to the belief that these factors in the combined movements of the transmitting apparatus throw new light upon the subject. And Bezold ascribes to the intrinsic muscles a considerable influence upon the exact adaptation and the maintenance of equilibrium of the different parts of the sound-transmitting apparatus. Bezold infers, from the insertion and direction of traction (parallelogram of forces) of the stapedius, that this muscle, in spite of its diminutive size, as opposed to the tensor, is able to maintain equilibrium to such a degree that the two muscles neutralize each other.

The result of the experiments on the round and oval windows appears to be of particular importance in determining the varying conditions of intra-labyrinthine pressure. The author's views are directly opposed to those heretofore entertained and advanced by Politzer, that by means of a depression of the membrana tympani, in consequence of a closure of the Eustachian tube and consecutive rarefaction of the air contained in the cavities of the middle ear, a permanent increase of lateral pressure is found in the labyrinth. Bezold, however, deduces the following

conclusion from his experiments: "A diminution of atmospheric pressure in the middle ear is attended by a temporary diminution of intra-labyrinthine pressure, and *vice versa*."

5. DOLBEAR publishes a brief report of a new method of determining the least number of vibrations which are necessary for the continuous perception of sound. The experiments given must be considered as purely individual, depending upon the capacity to perceive sounds. This differs widely in different persons. The following device assisted materially in recognizing pitch with only three or four vibrations: Let the finger-nail be drawn across a piece of ribbed paper or cloth, such as is now used for binding books, and a whistling sound will be heard and the pitch can readily be determined.

6. EDISON presented a new tuning-fork to the "American Association for the Advancement of Science," which he termed a "resonant tuning-fork." Those instruments heretofore used are, as is well known, attached to a resonant wooden box, whose vibrating period is the same as that of the fork. In Edison's apparatus the box is dispensed with, the resonant chamber being formed by the prongs themselves. "To make the fork, a thick bell-metal tube has one end closed, a slit is sawed through the centre of the tube nearly to the closed end. This divides the tube, and gives two vibrating prongs. To bring the prongs in unison with the column of air between them, the tube is put in a lathe and turned thinner until the unison is attained, whereupon the sound is powerfully reinforced."

Blake adds that this device "is especially useful to the aural surgeon in conducting comparative tests of the duration of perception of musical sounds."

7. SPAMER'S experiments were made on full-grown pigeons; for young ones, owing to the unavoidable injury of the circulatory apparatus, are not adapted to the purpose. After a little practice it is not difficult to open all the semicircular canals by means of a small, sharp knife, without interfering with any of the neighboring parts.

He made simple incisions of the bony canals, and also transverse incisions into one or more of the cartilaginous canals. Both gave rise to only limited and transient disturbances of equilibration. If, however, one or all of the canals are thoroughly destroyed and the ampullæ entirely removed, then the animal will lose all of its power of coördination, and will tumble off its perch.

Even after it has fallen to the ground it cannot remain quiet, but will tumble in all directions, and, after a little time, the to-and-fro movements of the head will set in.

In the chapter "on the sequels of operations on the canals," we find an interesting résumé of the microscopic examinations of the cerebellum, which Stephani and Weiss published in a memoir read before the Academy of Ferrara. These experimenters found destructive changes of Purkinje's cells of the cortex of the cerebellum. Instead of seeing regular spindle-shaped cells containing nucleus and nucleoli, they only found irregular dark bodies whose nuclei were hardly recognizable.

The facts tend to substantiate the assumption that the semicircular canals are peripheric organs whose centres must be sought for in the cerebellum.

In the "theoretical" part of the monograph, Spamer summarizes his conclusions in the following paragraphs :

"There is no doubt that the cartilaginous semicircular canals of the inner ear, as well as their ampullæ, are of paramount importance in regulating muscular movements.

"They, in all probability, are not at all concerned in the function of hearing.

"But we are not justified in considering them as organs regulating the power of coördination.

"Anatomical as well as experimental and pathological conditions tend to show that these canals are a peripheric organ, representing a 'special sense' (Goltz) of equilibrium, or a static sense, according to Breuer.

"They cannot, however, be the only organ regulating the power of equilibration and the coördination of movements dependent thereon, for complete destruction of all the canals does not deprive a man of all power of movement. Also experimental destruction in animals does not cause the highest degree of unsteadiness, although it permanently impairs the freedom of movement, as Flourens and Goltz have already proven.

"No satisfactory explanation as to how the above-mentioned functions are produced in the canals has yet been given.

"Irritation of the canals, whether mechanical, thermic, chemical, or electrical, will produce much greater motor disturbances than simple excision. The most numerous and decided disturbances of motion observable after operations on the canals must be considered as the result of irritation."

The reporter cannot endorse all these conclusions,* nor can he find that the author's experiments prove anything for or against the belief, entertained by other investigators, that the semicircular canals are concerned in the mechanism of hearing.

8. DUVAL reports on divisions of the semicircular canals. He believes that the centre of the sense of space, is situated in the cerebellum. He calls attention to the fact that the acoustic nerve sends an offshot into the funic. restiform., and thence to the cerebellum "au dessus des cordes du calamus scriptorius" (probably the striæ acusticæ). M. Laborde confirms these statements, and in division of the horizontal canals of a fowl, has observed the same condition as in a puncture of the pédoncule cérébelleux inférieur.

9. LANDOIS tells us how he succeeded in producing audible vibrations in a gas-light, so that the clang tint as well as the pitch of given notes was heard. These experiments are supplementary to König's vowel light-images.

III.—EMBRYOLOGY AND COMPARATIVE ANATOMY OF THE EAR.

BY PROF. LUDWIG LÖWE.

Translated by Dr. W. C. AYRES, Resident Assistant Surgeon to the N. Y. Ophthalmic and Aural Institute.

1. KUHN. Contribution to the anatomy of the ear. Part II., on the membranous labyrinth of amphibia. *Arch. of microscop. Anat.*, Bd. xvii, pages 479–550; 6 tables.

2. BORN. The nasal cavities and the lachrymal passages of the amniote vertebrates. *Morpholog. Jahrb.*, Bd. v, H. 1 and 3.

3. LÖWE. Contribution to the anatomy and development of the brain of mammals and man. *Berlin. Denicke*, 1880; 576 pages of text; 18 plates, folio.

*Cases are on record in which pathological changes were present within the semicircular canals, although there was no interference with equilibrium. Moos described two cases which were carefully examined *post mortem*, and in which there were no symptoms during life. In one of these there was hemorrhage into the entire labyrinth in consequence of a gun-shot wound (*Arch. of Ophth. and Otology*, vol. ii, part i, page 343, *et seq*); in the other numerous isolated hemorrhages into the labyrinth were found, which were due to hemorrhagic pachymeningitis (*Arch. of Otol.*, vol. ix, page 105, *et seq*).

The embryology and anatomy of the ear of amphibia has been but little studied in comparison with the publications on the same organ in fishes, birds, and mammals. This is especially astonishing, since in these particular vertebrates we find the beginnings of the basilar parts of the cochlea, which are of so much importance for the higher vertebrates, and since, furthermore, the inner ear of the various classes of amphibia shows so plainly the different comparative stages in the formation of the cochlea.

The inner ear of the anoura, and in particular that of the ranida possesses, in the plainest and best-developed form, all those organs which, still missing in fishes, Kuhn was able to detect in the amphibia.

The inner ear of the amphibia, as well as of the fishes, is placed on the posterior lateral wall of the skull, between the openings of the canals for the exit of the trigeminus and the vagus.

In amphibia the membranous inner ear is surrounded by a capsule of bone, closed on all sides.

The membranous labyrinth of fishes is similar to that of amphibia, with the exception that in these the pars inferior shows a higher development of the different segments of the cochlea. In the cavity containing the sacculus and lagena, two new organs are found, the pars initialis and the pars basilaris; moreover, in the ranida, the segmentum vasculare.

The pars basilaris cochleæ makes its first appearance in the siredon, is larger in the triton and salamander, and in the frog it is a cartilagineous ring, at the central end of which a large branch of the cochlear nerve enters, in its interior forming a crista acustica. In this new-formed part of the cochlea we find the beginning of the membrana basilaris, which is of so much importance in the higher vertebrates. Finally, a fourth part of the cochlea appears in the batrachiæ, viz., the segmentum vasculosum. This is also noticed in birds.

In the teleosts the nervus acusticus is divided into three branches; in amphibia, into two, a vestibular and a cochlear branch. The former goes to the recessus, to both the ampullæ, and to the sacculus; the latter supplies all the parts of the cochlea, and also the frontal ampulla.

In amphibia the layer of the maculæ and cristæ auditivæ is composed of only two kinds of cells, basement and cylinder cells. The third cell-stratum, the filament cells of the fishes, is wanting, and therefore cannot form the connection of the axis cylinders with the auditory cells.

The pale axis cylinders, which come from the basilar edge, pass directly to the inferior ends of the cylindrical cells, or combine with other axis cylinders to form the plexus intra-epithelialis, pass upward to go to the inferior ends of the auditory cells, or to run between them to the surface, showing a free termination.

The tissue of which the membranous labyrinth is composed is "fusiform cartilage," and the cavities of the labyrinth are lined with polygonal pavement epethelium, both in fishes and amphibia.

All authors agree that the naso-lachrymal canal of the amniotes is formed by the closure and transformation into a tube of a groove which, at a certain period, is situated between the external nasal and the superior maxillary process. Born found that it begins with the formation and separation of an epethelial ridge as in amphibia.

There are remarkable differences in the development of the naso-lachrymal ducts in amphibia, reptiles, and birds; but in all they first appear as epithelial ridges penetrating from the epidermis in the cutis.

IV.—PATHOLOGY AND THERAPEUTICS OF THE EAR.

By A. HARTMANN, Berlin.

Translated by W. C. Ayres, M.D.

1. Dr. K. Bürkner, Göttingen. Report of the cases of ear disease observed in my polyclinic during the year 1879. *Archiv für Ohrenheilk.*, Bd. xv, page 56.

2. Dr. Hugo Hessler. Statistics of the cases examined and treated in the polyclinic at Halle, from the winter of 1871 until the summer of 1879 inclusive. *Archiv für Ohrenheilk.*, Bd. xv, page 68.

3. Prof. A. Burckhardt-Merian, Basel. Statistical collection of the cases of ear disease observed in my polyclinic and private practice in 1874–1879. *Archiv für Ohrenheilk.*, Bd. xv, page 84.

4. Patterson-Cassells, Glasgow. Report of the aural work done in the Glasgow Royal Infirmary, from November 1, 1877, to November 7, 1879. *The Glasgow Med. Journal*, vol. xiii, 1, 2, 3, 4.

5. H. Steinbrügge, Heidelberg. Communications from the

clinic of Prof. Moss. German edition of these ARCHIVES, Bd. ix, page 137.

6. URBANTSCHITSCH. Ear diseases in their connection with life insurance companies. *Allgem. Wien. Med. Zeitung*, No. 9, 1880.

7. Dr. V. GRAZZI, Milano. Otorrhœa; its causes, effects, and therapeutics. 1880.

8. Dr. GRUBER, Wien. Galvano-cautery in otology. *Allgem. Wien. Med. Zeitung*, No. 1, 1880.

9. Dr. KATYSCHEW. On the excitations of the vessels by faradisation at the neck. *Petersb. med. Wochenschr.*, No. 5, 1880.

10. S. SEXTON, New York. Note on tinnitus aurium. *The Brit. Med. Journal*, June 26, 1880.

11. M. BOUCHERON. On the method of treatment of certain forms of deafness, and deaf-mutism in children. *Gazette Méd. de Paris*, No. 19, 1880.

12. Prof. WHARTON JONES. Clinical lecture on the elucidation of the nature and methods of treatment of diseases of the ear, with reference to our knowledge of the nature and treatment of diseases of the eye. *The Lancet*, Feb. 7, 1880.

13. A. BURCKHARDT-MERIAN, Basel. A new handle for ear instruments. German edition of these ARCHIVES, vol. ix, page 166.

14. CH. TODD, St. Louis. A simple modification of the hand atomizer. *The American Journal of Otol.*, vol. ii, page 35.

15. Dr. JACQUEMART. A new otoscope. *Le Progrès Méd.*, No. 21, 1880.

16. Dr. BARANOUX. A new polypotome. *Le Progrès Méd.*, No. 17, 1880.

17. C. S. TURNBULL, Philadelphia. The new folding dentaphone, etc. These ARCHIVES, vol. ix, page 80.

18. EDMUND TREIBEL, Berlin. On the use of the dentaphone by deaf-mutes. These ARCHIVES, vol. ix, page 305.

19. Dr. W. GUDE, Director of the Institution for Deaf-mutes in Stade. Leipsic. The laws of physiology and psychology to be observed in teaching deaf-mutes to articulate. 1880.

2. The statistical tables of Hessler-Schwartze and Bürkner are accompanied by explanations and reports of cases.

HESSLER draws particular attention to the operations of Schwartze. Paracentesis of the drumhead was made 28 times, and always with good results; polypus operation 12 times; Wilde's

incision 6 times ; operative opening of the mastoid antrum 7 times. Seven cases of nervous deafness, caused by injury, are reported in full. In one case, which was cured, hearing was greatly and rather suddenly impaired on both sides. Symptoms of syphilis were in the throat and other parts of the body. The condition of the ears is not stated. On the sixth day of the use of mercurial ointment, the patient heard a snap in both ears while drinking water, followed by a very great improvement in hearing ; a complete cure was the result. The case was considered as one of nerve-deafness, produced by constitutional syphilis. (The improvement of hearing after a snap is evidence that the affection was chiefly in the middle ear. K.)

4. PATTERSON-CASSELLS' report of the work done in the Royal Infirmary in Glasgow. 1,039 patients were treated. The report includes 491. Hereditary or acquired syphilis was found to be a frequent cause of ear trouble. While the disease shows itself in the eye, as kerato-iritis, at the age of 7–8 years, it manifests itself in the ear only after the diseases of the eye have subsided. The ear trouble developes rapidly, and in the most cases results in complete deafness. Several cases of acquired syphilis presented the same conditions as the congenital form. In one case Cassells could notice the progress of the changes in the drum-head, which was transformed from the normal to a white fibrous tissue. This could only be cut with a sharp knife by using considerable force. In one case there was a bony closure of the external canal, in which the hearing improved very much after removal of the bone. The description of the operation will appear later. At the end of the description of a case of othæmatoma, Cassells reports his observations in an insane asylum. Some of the cases will be more fully published later.

6. URBANTSCHITSCH's paper on ear disease in reference to life insurance, is the more highly to be appreciated since there is no other thorough discussion of this important subject. In the prognosis of wounds of the ear, attention must not only be paid to their influence on the ear itself, but also to the secondary effects they have on adjacent organs.

The points of distinction made by him are remarkably clear, and will remove many of the present difficulties in diagnosis and prognosis. His preceding remarks are illustrated by several medico-legal opinions on special cases. After traumatisms the effect of certain aural affections on illegal actions is detailed, and atten-

tion is drawn to the reflex psychoses which are caused by diseases of the ear.

7. GRAZZI. The monograph containing 104 pages on the treatment of otorrhœa, as produced by otitis externa and inflammations of the middle ear, is very complete.

8. GRUBER, in speaking of galvano-cautery, says the deeper we operate in the ear the more care must be taken. If severe subjective symptoms be produced, the application must be withheld. The point for cauterization must be definitely known. In applications to the bony parts of the ear the area cauterized at one sitting must be small; in the region of the round and oval windows the reaction is always intense; before repeating an application the reaction of the last must have completely subsided. Gruber uses galvano-cautery principally for the removal of new formations of bone and cartilage from the external canal, for the destruction of polypi, and for operations on the drumhead. He also predicts that it will be used in artificial openings of the mastoid process.

9. The experiments of Katyschew and Dr. Dobroworsky, on the effect of faradisation at the neck and the consequent narrowing of the blood-vessels, give the following results:

By the faradisation of the sympathetic fibres in the neck, the inflammatory redness of the drum-head and the middle ear in myringitis and perforative tympanic disease, is rendered less intense and the subjective sensations (pain and noises) diminish at the same time The hearing is also improved, and in some rare cases brought up to the normal standard. The effect commences during faradisation, and if the application is made from five to fifteen minutes it lasts for several hours after. By galvanization also the inflammatory redness of the drum-head decreases, but the effects are not so constant nor so decided; only the closing, opening, and variations in intensity of the current have this influence.

10. SEXTON draws attention to noises in the ear, and thinks that their cause is most frequently to be found in the neighboring blood-vessels. In addition to this, he concludes from his experience that many kinds of noises in the ear, which he formerly thought were the result of some abnormal condition of the inner ear, have their origin in changes in the sound-conducting apparatus.

11. BOUCHERON is of the opinion that hardness of hearing and deafness, both in children and adults, are most frequently

the result of affections in the naso-pharyngeal cavity, and in stenosis of the Eustachian tube. He recommends the use of chloroform in the catheterization of small children, and says two or three inhalations are sufficient to keep a child still for a minute or two.

(Boucheron seems to forget that in children inflation is mostly successful without the use of the catheter.)

12. WHARTON JONES makes a general comparison between the affections of the eye and those of the ear, and thinks that by analogy we can often draw inferences from the better known conditions of the eye, to the nature and treatment of affections of the ear. He describes the different diseases of the two organs which are analogous.

14. TODD uses a bottle with a hole near the top, which can be left open or closed with the finger, in order to bring about a sudden cessation in the working of a spray apparatus.

16. The new polypotome of Baranoux, is a pair of forceps with hollow branches through which a wire can be passed. The handles make an obtuse angle with the branches. On one branch of the handle is a canula, as in the ordinary polypus snare, to which the wire is fastened, and by which the strangulation is effected. The snare opens by the separation of the two branches.

19. In GUDE'S paper (80 pages) the means of excitation by which the deaf and dumb may be taught how to articulate, are discussed with a great display of psychological and physiological wisdom. Special attention is paid to the forms of excitation used in the beginning of the instruction of deaf-mutes, that is, the means used to teach them to place the organs of articulation in the proper position, and to move them properly, the "optical images of sounds serving as excitation of motion," furthermore, the impressions received by the organ of touch. We must leave undecided how much credit the author deserves for discussing, from a psycho-physiological standpoint, the methods of instruction which among deaf-mute teachers have been in daily use.

EXTERNAL EAR.

20. ALB. H. BUCK, New York. The comparative value of leeches, heat and incisions, in the treatment of acute circumscribed inflammations of external ear. *The American Journal of Otology*, vol. ii, p. 25.

21. Dr. WEBER-LIEL, in Berlin. On the abortive treatment of furuncular inflammation of the outer ear. *Deutsche Med. Wochenschrift*, No. 15, 1880.

22. URBAN-PRITCHARD, LONDON. A case of foreign body in the ear, giving rise to severe cerebral symptoms. Removal resulting in a cure. *The American Journal of Otology*, vol. ii, p. 9.

23. A. GARDINER-BROWN. Ivory exostosis in the external ear-canal. Removal. Cure. *The Lancet*, March 13, 1880.

24. W. A. M'KEOWN, Belfast. On a method of treatment of relaxation of the membrana tympani. The *Dublin Journal of Med. Science*, June, 1880.

25. Dr. A. MAGNUS, Königsberg. The rupture of the drumhead resulting from a blow. *Allgem. Wien. Med. Zeit.*, No. 3, 1880.

20. BUCK comprises under the term circumscribed inflammation of the external canal, only those inflammations which are located in its cartilaginous portion, and lead to a circumscribed conical or hemispherical swelling. In 28 cases he incised the swollen tissue. In eight of these, the pain was materially and permanently relieved. In three, the pain disappeared completely. In six there was no improvement, or at least, none that was lasting. Before recommending early incisions, we ought to know the average time of cure in cases thus treated, in comparison with such as are cured without incision, for only by such a comparison can recommendations have a scientific value. In the eleven cases in which no incision was made, the disease was just as severe as in the seventeen in which it was resorted to. The comparison showed that in the eleven, the period of pain was no longer on the average than in the seventeen in which the incision was made. This period varied from five to seven days. Leeches, douches, dry and moist warmth, according to Buck, have the same effect as incisions, and at least diminish the severity of the pain. These means are painless, and Buck obtained better and more uniform results from them than from any severer ones.

21. According to the experience of Weber-Liel, the use of spirit. vin. rect. to cut short furuncles of the external canal, is only to be resorted to in the very beginning of the process. He now uses subcutaneous injections of a weak solution of carbolic acid for this purpose. The injection must be made 1–2 *mm.* deep, according to whether the painful spot is swollen or not. From 2

to 4 drops of a-5-per cent. solution are injected. Three hours after this, the spirit ear-baths are continued. In the beginning of the disease, one injection will be sufficient; in more advanced cases, several are necessary. Neither the number of cases treated in this manner, nor the duration of the treatment, are stated.

22. Inflammation with severe pain and high fever was caused by a bean which remained in the external canal for five years. Pritchard caused the patient to be narcotized, and, after many attempts, drew it out with a hook passed between the foreign body and the wall of the canal. The severe cerebral symptoms of which he treats in his paper, consisted in intense occipital pain.

23. The ivory exostosis described by Gardiner-Brown originated from the posterior wall of the canal and was 6 *mm.* long, from above, downward. The tumor was very sensitive to the touch, was covered by a pale delicate membrane, and almost closed the external canal. The operation of removal was done with a dentist's drill, in such a manner, that at first a small hole was bored in the middle, and then several smaller ones at the base of the tumor. An attempt was made to remove the growth with an instrument which was screwed into it, but broke. First a small piece containing the broken screw, and then the whole tumor were removed with a pair of forceps. The tumor was 11 *mm.* long, 8 *mm.* thick and 7 *mm.* broad. The drum-head, ruptured during the operation, inflamed, and granulations developed. The case resulted in cure with perfect restoration of hearing. Syphilis or hereditary predisposition was not present. Brown believes that the tumor followed an attack of measles.

24. McKeown communicates that, according to new experiences, his method of treatment of relaxation of the drum-head (these Archives, vol. viii, pag. 363) answers his expectations. He uses it almost daily, and assigns to it an important place in the therapeutics of ear affections. As a clinical symptom of relaxation of the drum-head, he considers the frequent and sudden change in the acuteness of hearing caused by the motions of the membrane; also the sensation of opening and closing of the ear, and a feeling as if the canal were plugged. By the use of Valsalva's experiment the hearing is improved, but as soon as the membrane collapses again, the former condition returns. McKeown describes the first case that he treated with collodium Ordinary conversation was heard at three feet, the voice of

others was heard confusedly, and the patient's own voice had an unnatural tone, and produced very annoying noises. He had been treated for three years without result. Between the hammer and the posterior wall, the membrane was strongly drawn inward, but after Valsalva's experiment, it greatly protruded. After the application of collodium, conversation was heard at a distance of eighteen feet, and the noises completely disappeared. The collodium was again applied after three months, and the cure remained permanent. The relaxed portion of the drum-head had regained its normal tension.

25. MAGNUS does not consider the traumatic rupture of the drum-head a serious injury on account of its favorable prognosis, which is contrary to the legal view, and also to the generally accepted opinion. In one case that he describes, the rupture could only be recognized by a straight red line which did not open on forcing air into the tympanic cavity. In order to diagnose a rupture with certainty, he recommends the placing of an india-rubber tube into the canal with the other end held before a flame, and the forcing of air into the Eustachian tube with a catheter. Injections of water are to be avoided on account of the irritation they produce.

THE MIDDLE EAR.

26. ST. JOHN ROOSA, New York. A case of acute inflammation of the middle ear, combined with inflammation of the muscles of the neck and paralysis of the facial nerve, etc. These ARCHIVES, vol. viii, page 255.

27. ALB. BURCKHARDT-MERIAN. On scarlet fever in its relations to the ear. *Samml. Klin. Vorträge*, No. 182.

28. CH. E. HACKNEY, New York. On the use of Toynbee's artificial drum-head. These ARCHIVES, vol. viii, page 228.

29. CH. H. BURNETT, Philadelphia. Uninterrupted wearing of cotton pellets as artificial drum-heads. *The Amer. Journ. of Otology*, vol. ii, page 15.

30. Dr. KÜPPER, Eberfeld. On pulsations of the drum-head. *Arch. f. Ohrenheilk.*, vol. xv, pag. 271.

31. CLARENCE J. BLAKE, Boston. A form of middle-ear syringe. *The Amer. Journ. of Otology*, vol. ii, page 5.

32. W. B. DALBY. The progress and termination of inflammation within the tympanum. *The Lancet*, February, 1880.

33. B. TORRANCE. Paracentesis of the membrana tympani in acute aural catarrh. *Brit. Med. Journ.*, May 8, 1880.

34. P. MCBRIDE and ALEX. JAMES. Epilepsy, vertigo, and ear disease. *Edinb. Med. Journal*, February, 1880.

35. Dr. K. BÜRKNER. On cases of traumatic and inflammatory middle-ear affections. *Arch. f. Ohrenheilk.*, Bd. xv, pag. 219.

36. Dr. ALBERT BING, Vienna. A new method of treating sclerosing inflammation of the middle ear. *Wien. Med. Blätter*, Nos. 15 and 16, 1880.

37. Prof. Dr. VOLTOLINI. Emphysema produced by inflation of the middle ear. *Monatsschr. f. Ohrenheilk.*, No. 5, 1880.

38. ED. NOAKES, London. Further observations on "throat deafness," with paresis of the salpingo-palatine muscles. *The Amer. Journ. of Otology*, vol. ii, page 22.

39. SWAN M. BURNETT, Washington. Objective perceptions of tones in the ear in consequence of voluntary contractions of the muscles of the tube. These ARCHIVES, vol. viii, page 357.

40. Dr. J. GOTTSTEIN, Breslau. On the pathogenesis of subjective sensations in the ear. Spasm of the musculus stapedius combined with blepharospasmus. *Arch. f. Ohrenheilk.*, Bd. xv, page 61.

41. Dr. PREUSS, Danzig. A case of one-sided deafness with a doubtful etiology. *Deutsche Militärztl. Zeitschr.*, page 35, 1880.

42. Dr. JACOBY, Breslau. On cases of primary and secondary periostitis and ostitis of the processus mastoideus. *Arch. f. Ohrenheilk.*, vol. xv, pag. 286.

43. E. ZAUFAL. On trephining the processus mastoideus. *Prag. Med. Wochenschr.*, No. 5, 1880.

44. G. KUSTER, Bern. On the so-called abscess in the brain produced by otitis. *Inaug. Dissert.*, 1880.

45. H. KNAPP, New York. A case of malignant tumor of the parotis and the tympanic cavity. These ARCHIVES, vol. viii, page 311.

27. In the introduction of a very interesting paper, Burckhardt-Merian gives the percentage of the occurrence of the inflammation of the middle ear in two epidemics of scarlet fever. In the first, this complication occurred in 33.3 per cent.; in the second, 22.2 per cent. He is of the opinion that the severe affections of the middle ear in scarlet fever are brought about by diphtheria which comes from the throat, and passes along the

tube into the tympanic cavity. According to his observations, pain in the ears occurs, in a great majority of cases, during the stage of desquamation, after the elevations of temperature have subsided. At first the pain occurs only in attacks, but later it assumes a neuralgic character, at the same time a slight degree of deafness very rapidly developes itself. Swelling of the glands in the vicinity of the ear is seldom absent. When the perforation of the drum-head takes place, the fever and the soporose condition diminish. The disease differs from the usual middle ear inflammation by the rapidity with which it produces extensive destruction of the drum-head. The milder affections of the middle ear in scarlet fever are not diphtheritic in character. The prognosis of diphtheritic affections of the middle ear, is less favorable the longer the condition goes without treatment. The treatment used by Burckhardt-Merian consists in the cauterization of the diphtheritic patches in the pharynx and naso-laryngeal cavity, with 10 per-cent. salicylic alcohol, and the application of ice-bags, as well for the diphtheria as for the inflammation of the middle ear. If the fever continues, the pain returns, and the mastoid process is tender on pressure, paracentesis of the drum-head must be made, followed by the use of Politzer. If suppuration sets in, syringe with a 5-per-cent. solution of Glauber's salts. Any diphtheritic membrane must be removed either with a polypus snare or a curette, and the surface impregnated with salicyl, alchol or with pure salicylic acid. By this treatment Burckhardt-Merian obtains a speedy cure, with subsequent closure of the defect in the drum-head.

29. BURNETT considers the cotton pellet of Yearsley the best artificial drum-head. From the observation of several cases, he comes to the conclusion that where the drum-head has been ruptured, and the inflammatory process has run its course, the cotton pellet works better when placed carefully in the ear by a physician and let remain there than when it is changed every day. This form of artificial drum-head not only serves the purpose of improving the hearing, but also assists in the cure of the affection.

30. According to Küpper, four things are necessary to bring about pulsating light reflexes. 1st, a cavity with rigid walls; 2d, the membrane lining the cavity must be very vascular; 3d, its opening must be relatively small; in the 4th place, he ought to have mentioned the presence of a liquid, but he only states that the presence of air in such a cavity is of particular interest. We

should have expected that it would prevent the production of pulsations.

31. BLAKE'S middle-ear syringe differs from that of Schalle and the reviewer in that it has very slender (0.5—1 *mm.* thick) tubes, which are firmly united to the syringe, and are slightly bent at their ends; whereas that of the reviewer, in order to give a sufficient stream, has canulas of double strength. These are likewise bent at their ends, but are united to the syringe by means of an elastic rubber tube.

33. TORRANCE relates a case of acute middle-ear inflammation treated successfully by paracentesis of the drum-head.

34. In a case related by McBride and Alex. James, the patient was afflicted with otorrhœa from his early childhood, and for three years had suffered from vertigo and epileptic attacks. While under treatment for the otorrhœa the ear improved, but no effect was had upon the attacks. These, however, yielded to the use of bromide of potassium. The authors inferred from the peculiar nature of the vertigo (the tendency to fall always to one side, and an apparent motion of objects toward the same side) that it was caused by the condition of the ears. Since the epilepsy was in close relation to the vertigo (both being cured by the bromide) they concluded that the epilepsy also was the result of the diseased condition of the ear.

35. BÜRKNER communicates two cases. In the first, very loud roaring and considerable difficulty of hearing, pain in the ear, and an unsteady gait, set in after a blow on the ear. On examination, the left drum-head was strongly drawn inward, and the entrance of air through the catheter gave severe pain, but rapid improvement on the administration of Politzer and the use of iodide and bromide of potassium. Bürkner thinks that the pain, etc., was caused by the drum-head and the ossicles having been pushed inward.

The second case was one of acute inflammation of the middle ear in a pregnant woman. The drum-head was of a deep blue-red color; was bulging, and had its epithelium detached in several places. A small zone of the anterior-inferior part was not pushed forward as the rest of the drum-head. He concluded that the condition was brought about by a blood vesicle or hæmatoma. On the 11th day two round ecchymoses about 3 *mm.* in diameter appeared on the red drum-head. He was inclined to connect the etiology of the condition with the pregnancy (al-

ready five months). A confirmation of his opinion he found in the fact that after confinement she did not complain of hardness of hearing or of pain in the ear.

36. BING communicates that in order to insure the entrance of injected fluid into the tympanic cavity in cases of sclerosing inflammation of the middle ear, he places the head of the patient in a horizontal position. This also prevents the fluid which he injects into the tube through the catheter from running out. After the compression of the air in the tympanic cavity, he causes a rarefaction to take place by allowing the balloon to fill itself again without removing it from the catheter.

37. In a patient of Voltolini emphysema occurred first on the same side and later on the other, after passing bougies into the tube and afterward forcing air into the ear through the catheter. The uvula was found puffed up with air, hanging like a fish bladder from the velum palati. The tumor disappeared after having been snipped with the scissors, as did also the irritation of swallowing and retching. Voltolini thinks that such an emphysema, produced by the use of an air-pump, could be so great as to cause instant death.

38. WOAKES compares his statement of throat deafness (see p. 85 of this volume) with Weber-Liel's description of progressive loss of hearing. In the history of the disease from both authors the principal factor is the paresis of the muscles of the velum palati. According to the opinion of Weber-Liel, the paresis leads to an antagonistic contraction of the tensor tympani, to noises, vertigo, and ultimately to a slowly progressing, but complete deafness. According to Woakes, it does not bring about any abnormal position of the drum-head, this membrane only losing its power of accommodation. Difficulty of hearing is pronounced in the beginning; noises are only occasionally heard, and vertigo is never present. Cure is rapid. Woakes endeavors to explain the difference by stating that the condition he describes is entirely another affection than that of Weber-Liel. This, he contends, comes from an exhaustion of the vaso-motor nerve force.

40. GOTTSTEIN believes that under certain physiological and pathological conditions the stapedius can also be active when we make a voluntary contraction of the muscles of the face. An observation which he makes in his own case, he considers confirmatory of his opinion. When he listens attentively to low distant

sounds, he narrows the palpebral fissure on the same side, and experiences a peculiar straining sensation in the ear, almost painful, analogous to that which is experienced when we hear a very loud, shrill sound. From the motions of the muscles of the face (which are controlled by the facialis) Gottstein concludes that also the stapedius contracts when we listen attentively.

A patient of his who suffered from blepharospasm on both sides, occurring from fifteen to twenty times a day, and lasting five to ten minutes, had always a noise in both ears, which passed off after the spasm of the lids had subsided. Later, the noises became continuous. These also stopped when a particular spot at the anterior angle of the processus mastoideus was pressed upon with the finger. They also disappeared during the application of an induced current of electricity. This treatment having been resorted to every day, the noises occurred only occasionally, and finally entirely passed away. Gottstein believes that the subjective noises were produced by a contraction of the musculus stapedius.

42. JACOBY reports three cases of primary periostitis of the processus mastoideus which were cured by an incision of the periosteum. He also relates six cases of opening of the mastoid. In the first case, inflammation of the mastoid with pain in the head, vertigo and stupor occurred after a small perforative inflammation of the middle ear. The normal corticalis chiselled open, but injections into the tympanic cavity could not be made (it is not stated whether there was pus in the mastoid cavity or not). Cure.

In the second case, a very painful abscess formed in the mastoid process, after chronic otorrhœa. Repeated incisions were made. On the introduction of a probe, caries and a fistulous canal were found. Chiselling was not resorted to. An abscess by gravitation was found in the neck, which, by pressing on the trachea, caused the death of the patient.

The third case had reference to the opening of a bony fistula with a chisel and a sharp spoon, in a boy. The length of the canal of the operation was extraordinary (2½ *cm.*); it was carried through the corticalis, which was hypertrophied to about three times its usual thickness. Cure.

In the third and fifth cases there was a collection of pus in the mastoid, with the formation of an abscess on the surface; the carious corticalis was chiselled away. Both cases recovered,

but the last passed through a complication of erysipelas. In order to prevent a retention of pus, Jacoby recommends energetic syringing and irrigation under considerable pressure, in order to force the fluid through the wound into the ear. (The necessity of such a procedure, however, is by no means substantiated by the cases he reports. REVIEWER.)

The sixth case was a necrosis of nearly the entire temporal bone, which was afterward operated and described by Gottstein. (These ARCHIVES "Report on Normal and Pathological Anatomy," p. 363 of this volume).

The seventh case was the opening of an abscess in the mastoid cavity with cerebral symptoms (pain in the head, vomiting and stupor). Death occurred four days after the operation. No *post-mortem* examination.

43. ZAUFAL reported three cases of operative opening of the mastoid cavity in a lecture before the Association of German Physicians in Prague. Two of them resulted in cure. In the third case an attempted removal of sequestra did not prevent a fatal result. Zaufal lays much stress on the existence of fistulæ in the posterior superior wall of the meatus to render the diagnosis certain.

44. KUSTER begins his dissertation of the so-called cerebral abscess produced by otorrhœa in the usual way, viz., by making an historical survey, stating chiefly the former opinions on primary and secondary otorrhœa cerebralis. At the end of his paper he gives the etiology and pathological anatomy of the condition, and quotes 44 cases from the literature of the subject. Some of these are tabulated and some are accompanied by their complete history.

In 31 cases the cerebrum was affected (temporal lobe 16 times); in 17, the cerebellum (multiple abscess also included). Caries of the bones is not necessary to the production of an abscess; it occured in 34 cases only (77 per cent.). In 5 of these a fistula was found between the carious bone and the abscess, and in 5 cases the abscess was surrounded by normal brain substance. Among 39 cases Kuster found only 3 of acute abscess. The latent formation (as Hugenin has shown) is explained by the fact that the suppuration in the brain produced by otitis usually attacks the temporal lobe, where there are no motor nor sensitive nerve fibres. The first acute symptoms frequently appear only after the abscess has existed for some time. They set in with severe and constant

pain in the head, and if the abscess be in the cerebellum, the pain is principally in the occiput. As further symptoms we have vertigo, apathy, vomiting, sopor, occasional deliria and impediments in speech and gait. Death sometimes occurs suddenly, but generally the disease runs a slow course. The pulse varies in frequency and rhythm. In cases reported by Toynbee and Wreden the pulse sank to 16–20, and even to 15 and 10 beats per minute. The conditions of the fever are also very irregular. There is no pathognomonic symptoms of cerebral abscess, but the most important is violent pain located in one particular spot, combined with symptoms of pressure. The principal treatment is prophylactic, as the abscess can only be treated symptomatically (narcotica).

NERVOUS APPARATUS.

Translated by Dr. R. O. Born.

46. Dr. A. Bing. Acute one-sided deafness; cure. *Wien. Med. Wochenschr.*, No. 11, 1880.

47. Gustav Brunner, Zurich. An interesting case of long-continued deafness, caused by the detonation of a gun, with critical remarks. These Archives, vol, ix, p. 333.

48. Dr. Louis Blau, Berlin. Observations on labyrinthine disease. *Arch. f. Ohrenheilk.*, vol. xv, p. 225.

49. A. Guye, Amsterdam. Ménière's disease; a lecture. These Archives, vol. ix, p. 230.

50. J. Gottstein, Breslau. Ménière's complex of symptoms. These Archives, vol. ix, p. 255.

51. August Lucae. The good perception of the deeper musical tones in hardness of hearing, and its physiological and diagnostic importance, with two *post-mortem* examinations of cases which had been observed during life. *Arch. f. Ohrenheilk.*, vol. xv, p. 273.

52. Dr. Habermann. Cases from the otiatric clinic of Prof. Zaufal. *Prag. Med. Wochenschr.*, No. 22, 1880.

53. Dr. J. Fritsch, Vienna. A case of word-deafness. *Wien. Med. Presse*, No. 15, 1880.

54. Dr. P. Kahler and Dr. A. Pick. Contribution to the history of word-deafness. Anticritical remarks. *Zeitschr. f. Heilk.*, vol. i, H. 1.

46. BING reports the case of a woman who, after exposure, grew, within two days, completely deaf in one ear, and moderately hard of hearing in the other. The presence of syphilis was denied. No vertigo, vomiting, nor difficulty in walking. The objective examination negative; no change after inflation. Treatment: emplastr. vesic. and iodide of potassium. Cure after six weeks. Bing thinks there was a rheumatic affection of the acoustic nerve, a disease thus far not mentioned.

48. The first three cases, observed by Blau, were caused by an injury; twice a gun-shot wound of the ear, once a blow at the skull. In the first two cases he assumes that the symptoms were caused by concussion of the labyrinth; in the third case, by hemorrhage into the inner ear. The fourth case presents the remarkable symptom of double hearing during the course of an acute purulent otitis. In the diseased ear tuning-forks and also the middle octaves of the piano were heard more than half a tone lower than on the healthy side. The further cases (in otorrhœa after scarlet fever; probably also labyrinthine disease and deafness caused by meningitis) present nothing of interest.

51. LUCAE speaks of the results of the test of hearing in two cases in which, later, autopsies were made. In the first case words were only heard when spoken with a loud voice directly into the ear. On the examination with a physharmonica, the deeper tones, from c^1 downward, were perceived much better than the high tones. The autopsy revealed, besides chronic middle ear catarrh on the left side, several sclerosed places in the vestibule of the labyrinth, many pigment cells in the left cochlea, and numerous otoliths on Corti's fibres. In the sacculi of the vestibule there were large black accumulations of chalk; a similar condition on the right side. The auditory nerves were normal. Lucae thinks that these changes were the result of an inflammation during childhood. The difficulty of understanding speech is, in harmony with Helmholtz's theory, explained by the gross changes in the vestibule, and since these changes were not present in the cochlea, musical sounds were perceived pretty well. In another group of cases also a diminution of the hearing power for the highest musical tones and for whispered voice is observed, while the perception of the deeper tones is normal or almost normal. Lucae examines with tuning-forks after Conta's principle. Another patient was very deaf for whispered voice, but had a perfect hearing power for a c^1 tuning-fork. At the autopsy he found the

conducting apparatus and labyrinth normal; the acoustic nerve had a gray, atrophic appearance. The microscopical examination showed that the fibres of the ramus vestibuli were, on the whole, normal; but the ramus cochlearis had very thin atrophic fibres, with considerable atrophy of the medullary sheath. Lucae supposes that a certain group of fibres of the auditory nerve (corresponding to the tone c^1) had still preserved their function. Lucae states that similar symptoms are frequently observed in patients with hardness of hearing.

52. HABERMANN communicates a case of hysterical deafness from Zaufal's clinic. A 15-year-old student experienced rapidly-increasing hardness of hearing, with headache and dizziness. After his admission to the clinic, complete deafness, hyperæsthesia of the scalp, total blindness, insensibility complete on the right side, partial on the left, and hyperæsthesia of the olfactory nerve. Vision returned soon, completely and suddenly; the hearing for short periods only. Silver coins, placed upon the skin, had no effect; but gold coins, applied around the ear, produced immediate improvement, and their repeated application led to gradual recovery. The second case was that of an hysterical girl, in whom hardness of hearing had followed an acute catarrh of the middle ear. The trouble was diagnosticated as hysterical, because it occurred after an inflammation of the middle ear had been perfectly cured, with restoration of hearing, and because, upon examination, no signs of another inflammation of the auditory organ could be found. Neither silver nor gold coins had any influence upon the impairment of hearing.

53. A woman, 80 years old, with hereditary taint, who had never had any serious disease, suddenly lost the power of intelligible expression. When questioned, or spontaneously, she always exclaimed: "Sacred Maria!" or fragments of the Lord's Prayer. She did not understand anything that was spoken to her, but otherwise she showed quite a satisfactory intelligence. The hearing of noises was normal; the visual perception was weakened; but she understood signs. There was, therefore, besides aphasia, at the same time paraphasia and deafness for words. Death from gangrene, œdema, bed-sores and collapse. The examination of the cerebrum showed on the left side softening of the lower parietal lobule, the adjoining posterior portion of the first and second temporal gyri, the posterior transverse temporal gyrus, and the posterior gyrus of the island of Reil. Only a few millimetres of

the second occipital gyrus of the occipital lobe were affected. Embolism of the parieto-sphenoidal branch of the left artery of the Sylvian fossa. An explanation of the symptoms by the pathological conditions, and a detailed discussion of their diagnostic value are given.

54. The paper of Kahler and Pick on the history of deafness for words, contains critical remarks on an essay of Mathieu. The authors demonstrate, by several examples, how atactic aphasia and deafness for words can be distinguished by their clinical features. As is well known, the principal difference between the two is that in aphasia both hearing and understanding of spoken words are present, but that in deafness for words, hearing is preserved while the understanding of words is missing.

NOSE AND NASO-PHARYNGEAL CAVITY.

55. Dr. ZIEM. Blenorrhœa of the nose and its adjoining cavities (ozæna). *Monatsschr. f. Ohrenheilk.*, No. 4, 1880.

56. Dr. G. LÖTZEL. Ozæna cured by iodoform. *Lahr. Allgem. Med. Centralzeitung*, No. 45, 1880.

57. THUDICHUM. On polypous and other morbid growths in the nose, etc.; their radical treatment by the galvano-cautery, and their relation to asthma. *The Lancet*, April 17, 1880.

58. Prof. Dr. VOLTOLINI, Breslau. Nasal polypi and their operation. *Allgem. Wien. Med. Zeitung*, No. 12, ff., 1880.

59. Dr. ZANDER, Eschweiler. The operation of nasal polypi. *Deutsche. Med. Wochenschr.*, No. 7, 1880.

60. ED. WOAKES. Cotton wool as a vehicle, etc., for the application of medicines to the nasal cavity. *The Lancet*, June 5, 1880.

61. HAMILTON, CORNER, DOUGLAS-HEMMING, THURSTON. The surgical treatment of epistaxis. *The Brit. Med. Journ.*, May 8, 22, 29, June 5, 1880.

62. Dr. VICTOR LANGE, Copenhagen. Critical remarks upon the name of "adenoid vegetations," and a new method of operation. *Monattschr f. Ohrenheilk.*, No. 5, 1880.

55. Starting from the idea that the aërostatic conditions resulting from different sizes of the nasal cavities are not sufficient to produce ozæna, but that a ferment is necessary to cause the decomposition of the secretions, ZIEM speaks of some possible

sources of infection: 1. Processes of putrefaction in the mouth. He observed in a patient, who for twelve days had kept a piece of cotton in a tooth, a severe rhinitis, with profuse and very offensive purulent secretion. 2. Infectious diseases, when the children are kept warm and in impure air. 3. Damp and moist dwellings. In favor of this supposition are cases in which ozæna ceases after a change of residence, and where it recurs after a return to the former conditions. 4. Infection of one person from another. A patient of Z.'s traced the occurrence of the disease distinctly to the use of a handkerchief of a woman afflicted with ozæna.

Ziem calls ozæna every blenorrhœa of the nasal passages, no matter how it had been acquired, as soon as it combined with offensive smell, and he does not wait until atrophy of the mucous membrane, large nasal passages, and crusts have been developed. He thinks that every blenorrhœa, when left alone, and when its original causes are allowed to continue, will take this course. From this view, large nasal passages and atrophy of the mucous membrane are not necessary attendants of ozæna, and the formation of crusts is not characteristic.

Ziem's therapeutics consist especially in the establishment of good hygienic conditions and in improving the constitution of the patient, besides the nasal douche, inhalations, and, in hypertrophy, the use of the galvano-cautery. When the frontal sinuses were affected at the same time, Z. could, in several cases, by Politzer's inflation, relieve at once headaches which before had been very severe.

56. Lötzel uses in the treatment of ozæna, iodoform 2.0 : 10.0 gum arabic, to be snuffed up on both sides three to six times daily. Six cases were cured in two weeks.

57. Thudichum speaks of his experience upon more than 300 nasal polypi; he rejects the use of the forceps. He has used for sixteen years the galvano-caustic platina snare, even before Middeldorpf employed it for this purpose, and described his method of using it at the time in *The Lancet*. The polypi in the posterior portion of the nasal cavity are drawn forward with hooks or forceps. T. uses no other than a valvular speculum, with a spring and without screws, and rejects Voltolini's or Zaufal's methods of examination. In order to compress the cavernous tissue of the lower concha, the probe or a small plate is most practical. T. removes the lower concha in two steps; first the cavernous tissue is cut off with a white-glowing wire, and then the osseous

concha is removed with a small forceps or with a hammer and chisel. Generally it is sufficient to remove a piece of 1–1½ inches. The adenoid growths are caught with a canula forceps and twisted. Every fifth case of chronic nasal affection was or had been complicated with asthma. It frequently disappeared after the removal of the polypi.

58. VOLTOLINI, in the introduction to his paper on nasal polypi and their operation, calls attention to his repeated observation of the occurrence of nasal polypi simultaneously with fibromata and carcinomata. He was the first to lay stress upon the dangers from the development of emphysema and asthma. The statement that he first remarked that the swollen conchæ might be taken for polypi is not quite correct, since Astley Cooper stated before him : "More than once have I seen this exuberance torn out with the forceps cruelly and unnecessarily." V. repeatedly mentions that he was the first to introduce, in 1867, the operation with the wire loop, but he remarks, at the same time, that Wilde had operated nasal polypi with the wire loop before 1850. V. rejects the straight tubes for the operation, and gives a detailed description of his method of operating, which has been laid down in his former papers, and which we, therefore, need not repeat in detail. V. has also removed protrusions of the septum by the galvano-cautery in repeated sittings.

59. ZANDER. With reference to a former communication of the reviewer on the operation of nasal polypi, in the same journal, Z. describes a method which, in two cases, he has used with good results. Z. secured a polyp which was situated in the naso-pharyngeal space by a thread passed through it by a Burow's needle, after which it was easy to apply the loop with Bellocque's tube around the stem. In the second case a similar procedure was followed from the anterior nares.

60. WOAKES recommends for the treatment of nasal disease the introduction of cotton tampons impregnated with different medicines. The tampon is secured by a thread introduced upon the floor of the nasal cavity and applied especially to the posterior parts of the nares. To prevent the tampons from being swallowed, the threads from both sides of the nose are tied under the septum.

61. The different surgeons who report in the *Brit. Med. Journal* upon the surgical treatment of epistaxis, agree in rejecting Bellocque's tube. Hamilton uses a stripe of linen, three feet

long, with which the different parts of the nose are filled. Corner recommends the spray of liquor ferri sesquichlor., 1:15 aq.; Douglas-Hemming stops the bleeding by injecting liquor ferri sesquichlor. diluted with equal parts of water. Barry stopped bleeding at once by pressing, with a forceps, a piece of lint, dipped in turpentine, upon the floor of the nasal cavity. Thurston uses Weber's nasal douche with cold water, and if this is not sufficient, a solution of chloride of iron.

62. The criticisms of Lange upon the name of adenoid vegetations are confined to some remarks upon the starting-point of the vegetations. For the operation Lange, instead of the sharpe spoon, uses a circular knife, which should be introduced from the mouth. The knife is distinguished from those heretofore used by the cutting edge being directed toward the side.

"Lehrbuch de Ohrenheilkunde" (Text-book of Otology), with 75 wood-cuts and 8 plates, by Dr. VICTOR URBANTSCHITSCH, Lecturer of Otology at the University of Vienna. Vienna and Leipsic. Urban & Schwarzenberg, 1880.

This text-book contains a very complete sketch of the present stand-point of Otology. Throughout the whole work we find a careful and diligent study, and not only a complete review of the literature, but the author has also endeavored to state his own stand-point, as gained by his personal experience and research. Many points are new, and we shall mention them later. The book is especially valuable by the clear arrangement of the material, thus considerably facilitating its study.

We do not intend to review in detail the entire contents of the volume, but shall confine ourselves to call attention to some points.

By beginning with the examination of the auditory organ and the general therapeutics, Urbantschitsch acquaints the reader at once with the practical part. Very appropriately, the air-douche is discussed very accurately, and especially the use of the catheter is minutely described. U. generally makes use of a metal catheter because it can be disinfected more easily, and the hard-rubber catheter is only recommended for unskilled hands, or if the patients have their own instruments, and for the injection of certain remedies. The procedure, accurately described in Frank's text-book, but regarded as Lowenberg's method, is by Urbant-

schitsch considered as the safest in inexperienced hands. As is well known, the point of the catheter, which is directed toward the ear opposite to the one to be inflated, is withdrawn to the septum narium and then turned 180°. In speaking of the perviousness of the tube in Politzer's method, when inflated through the one or the other nostril, the results of manometric determinations of the permeability of the tube are communicated, which, however, have not given any positive results.

In the chapter on the "Examination of the Acuteness of Hearing," the tests with spoken words and the conduction of the cranial bones are extensively discussed. A new feature in the examination of the patient are the curves of acuteness of hearing, which are added to the diagram for making records of cases, and which are further explained in one of the following chapters. By this method the actual hearing power during the treatment and course of the disease is graphically presented in a very clear picture.

He then treats of the general therapeutics and, in a special chapter, calls attention to the importance of a careful disinfection of the instruments.

U. divides the auditory apparatus, according to its function, into a sound-perceiving and a static organ, and therefore sides with those who regard the inner ear not only as an organ for hearing, but also for the maintenance of equilibrium.

In the special part, before speaking of the diseases, he gives a detailed description of the anatomy and physiology of the different parts. The numerous anatomical drawings are magnificently executed. The morbid processes have been very carefully described, and the literature in particular, also the earlier, is well appreciated. We must call special attention to the varied and frequently very interesting personal experiences of the author.

Besides the inflammatory processes, especially the nervous influences which play an active part in diseases of the ear, the primary and secondary neuroses, are more extensively described than in former text-books, and the secondary neuroses are again divided into direct, consecutive, and reflex processes.

The diseases of the inner ear have been treated of with the same care and diligence as the other chapters.

The preceding anatomical remarks contain, besides the anatomy of the labyrinth, also our present knowledge of those parts of the brain which are in intimate relation to the organ of hearing. U.

speaks favorably of the galvanic treatment by stating that he observed in some cases good results from the electric treatment of the acoustic nerve, but he does not enter into a full discussion of the subject.

The appendix contains an interesting treatise on the examination of the organ of hearing from a medico-legal stand-point, with special reference to the insurance companies.

The abundance of material, the excellent descriptions, and the comprehensive arrangement of the subject, will not fail to secure to Urbantschitsch's text-book a large number of readers.

INDEX OF AUTHORS TO VOLUME IX.

BRUNNER, G. On the Subjective Noises in the Ear 56

——— An Interesting Case of Protracted Deafness, caused by the Report of a Musket. With Remarks 333

BURNETT, SWAN M. A Case of Primary External Inflammation of the Mastoid 145

——— Abstract of American Otological Literature 102, 189, 277, 351

——— An Abstract of the Otological Papers read before the American Medical Association, held in New York, June 1-4, 1880 274

DILLS, THOS. J. A Case of Rupture of the Drum-head from a Box on the Ear. Rapid and Complete Recovery 154

ELY, EDWARD T. Skin-grafting in Chronic Suppuration of the Middle Ear 343

——— and D. B. ST. JOHN ROOSA. Clinical Contributions to Otology 16

FRÄNKEL, EUGENE. Contributions to the Pathology and Pathological Anatomy of the Organ of Hearing 203

I.—Otorrhœa of long standing; exacerbation by syringing; death.
II.—Chronic otitis media; knock on the head; death.
III.—Chronic otitis purulenta; facial paralysis; death.
IV.—Otorrhœa from scarlatina; polypi; scraping out of mastoid process; proliferation of cauliflower excrescences; death.
V.—Pebble in ear-canal; attempts at extraction; death from meningitis.

GOTTSTEIN, J. On Ménière's Complex of Symptoms . . . 255

GUYE, A. On Ménière's Disease 230

HARTMANN, A. Proceedings of the Section of Otology at the Meeting of the German Association of Physicians and Naturalists at Baden-Baden, 1879 . 1

——— Round-celled Sarcoma, Originating in the Tympanic Cavity 49

——— Brief Remarks on the Affections of the Auditory Organ, occurring in Typhus Fever 53

——— Report on the Pathology and Therapeutics of the Ear in the Second Half of 1879. 181, 279

——— In the First Half of 1880. 380

——— Deaf-mute Statistics of the Province of Pomerania and the District of Erfurt . . . 307

HOTZ, F. C. The Indications for an Early Trepanation of the Mastoid Process in Acute Purulent Otitis Media with Implication of the Mastoid Cells 156

——— Aural Complaints in Consequence of Malaria . . . 241

——— A Case of Primary Post-aural Abscess without Implication of the Middle Ear . . . 250

KNAPP, H. Some Observations Concerning the Value of the Audiphone 82

——— On Heredito-Syphilitic Affections of the Ear . . . 146

——— Perichondritis Auriculæ. 195

——— Report of the Meeting of the American Otological Society, held at Newport, R. I., July, 21, 1880 269

——— The Nitrate-of-Silver Treatment of Eczema of the Ear 346

LÖWE, L. Report on Embryology and Comparative Anatomy of the Ear, in the year 1879 91, 176

——— In the First Half of 1880 378

MICHAEL, J. Otitis Media Purulenta with Necrosis of the Inner Wall of the Tympanum and of the Mastoid Process . 222

——— Chronic Purulent Inflammation of the Middle Ear, and Abscess of the Brain, Existing Independently of each other . 226

MOOS, S. Extirpation of the entire Malleus, together with a Polypus Springing from its Manubrium 28

——— Surprisingly Increased Acuteness of Hearing for Low Tones, in a Case of Paralysis of the Right Facial Nerve . . 33

——— A Case of Loss of Taste after Extirpation of a Polypus Springing from the Region of the Stapes 35

——— On the Histological Alterations of the Labyrinth in Hemorrhagic Pachymeningitis (Hæmatoma Duræ Matris) . . 105

——— On the Diseases of the Ear in Locomotive Engineers and Firemen, which may Endanger the Travelling Public . 319

——— and STEINBRÜGGE, H. A Peculiar Modification of the Osseous Tissue in the Pyramid of the Temporal Bone . . . 300

POOLEY, T. R. A Contribution to the Pathology of the Organ of Hearing 37

I.—Multiple Exostoses of the Skull. Thrombosis of Left Lateral, Inf. Petrosal and Cavernous Sinuses. Acute Catarrhal Pneumonia of Both Lungs.
II.—Otitis Media Purulenta. Chronic Caries of Mastoid. Perforation. Purulent Meningitis.
III.—Otitis Media Purulenta (Traumatic?) Extensive Caries of the Temporal Bone. Perforation of the Mastoid. Death. Autopsy.

ROOSA, D. B. St. JOHN and Edward T. ELY. Clinical Contributions to Otology . . . 16

CASE I.—Loss of Hearing from a Kiss.
CASE II.—Alarming Syncope after cleansing the Ear.
CASE III.—Serious Syncope from Inflation of Middle Ears by Politzer's method.
CASE IV.—Vertigo from Singing High Notes.
CASE V.—Mastoid Abscess without Evidences of Disease of the External or Middle Ear.
CASE VI.—Mental Depression from Impacted Wax.
Mucus in the Tympanum.

SPALDING, J. A. Diplacusis Binauralis. A Self-observation. 330

STEINBRÜGGE, H. Cholesteatoma of the Right Temporal Bone, Perforating into the Region of the Semicircular Canals. Cerebral Abscess. Autopsy 21

——— Report on the Normal and Pathological Anatomy of the Ear in the Second Half of 1879 168

——— In the First Half of 1880. 353

——— and MOOS, S. A Peculiar Modification of Osseous Tissue in the Pyramid of the Temporal Bone 300

TREIBEL, EDMUND. On the Use of the Dentaphone with Deaf-Mutes 305

TURNBULL, C. S. The New "Folding Dentaphone" . . 80

WOLF, OSCAR. Report on the Physiology of the Ear in the Second Half of 1879 . 171, 290

——— In the First Half of 1880. 366

——— On the Function of the Chorda Tympani 293

INDEX OF SUBJECTS TO VOLUME IX.

American Medical Association. Abstract of Otological Papers at New York Meeting, June, 1880. By S. M. Burnett . . 274

American Otological Literature, Abstract of. By S. M. Burnett 102, 189, 277, 351

American Otological Society, Report of the Newport Meeting of, in July, 1880. By H. Knapp 269

Anatomy, Report on Normal and Pathological. By H. Steinbrügge 168, 353

Audiphone, Observations concerning the Value of the. By H. Knapp 82

Cholesteatoma of Temporal Bone. Autopsy. By H. Steinbrügge 21

Chorda Tympani, On the Function of the. By O. Wolf . . 294

Clinical Contributions to Otology. By D. B. St. John Roosa and Edward T. Ely. (See index of authors.) 16

Deaf-mute Statistics in Pomerania and Erfurt. By A. Hartmann 307

Deafness, Protracted, from the Report of a Musket. By G. Brunner 333

Dentaphone, The new Folding. By C. T. Turnbull 80

——— The Use of the, in Deaf-mutes. By E. Treibel . . . 305

Diplacusis Binauralis. A Self-observation. By J. A. Spalding 330

Drum-head, Case of Rupture of, from Box on Ear. By T. J. Dills 154

Eczema of the Ear, the Nitrate-of-Silver Treatment of. By H. Knapp 346

Embryology and Comparative Anatomy, Report on. By L. Löwe 91, 176, 378

Labyrinth, Histological Alterations of, in Hemorrhagic Pachymeningitis. By S. Moos . . 105

Locomotive Engineers and Firemen, Ear Disease in. By S. Moos 319

Low Tones, Increased Acuteness of Hearing for, in Facial Paralysis. By S. Moos . . . 33

Malaria, Aural Complaints in Consequence of. By F. C. Hotz 241

Malleus, Extirpation of the Entire, Together with Polypus Springing from its Manubrium. By S. Moos 28

Mastoid, Case of Primary External Inflammation of. By S. M. Burnett 145

——— The Indications for an Early Opening of the, Process in Acute Otitis Media. By F. C. Hotz 156

Ménière's Disease. By A. Guye 230

——— Complex of Symptoms. By J. Gottstein 255

Noises, Subjective, in the Ear. By G. Brunner 56

Osseous Tissue, Modification of, in Temporal Bone. By S. Moos and H. Steinbrügge 300

Otitis Media Purulenta, with Necrosis of Inner Wall of Tympanum and Mastoid Process. By J. Michael 222

——— Chronica, and Abscess of the Brain, Existing Independently of each other. By J. Michael 226

Pathology and Pathological Anatomy, A Contribution to. By T. R. Pooley. (See index of authors.) 37

——— By E. Fränkel. (See index of authors.) 203

Pathology and Therapeutics, Report on. By A. Hartmann . 181, 279, 380

Perichondritis Auriculæ. By H. Knapp 195

Physiology and Physiological Acoustics, Report on. By O. Wolf 171, 290, 366

Post-aural Abscess, A Case of Primary, without Implication of the Middle Ear. By F. C. Hotz 250

Sarcoma, Round-celled, Originating in Tympanic Cavity. By A. Hartmann 49

Skin-grafting in Chronic Inflammation of the Middle Ear. By E. T. Ely 343

Syphilitic, Heredito-, Affections of the Ear. By H. Knapp . 146

Taste, Loss of, after Extirpation of a Polypus. By S. Moos . 35

Typhus Fever, Aural Affection in. By A. Hartmann . . . 53